

GALILEO:

AND HIS CONDEMNATION

BY

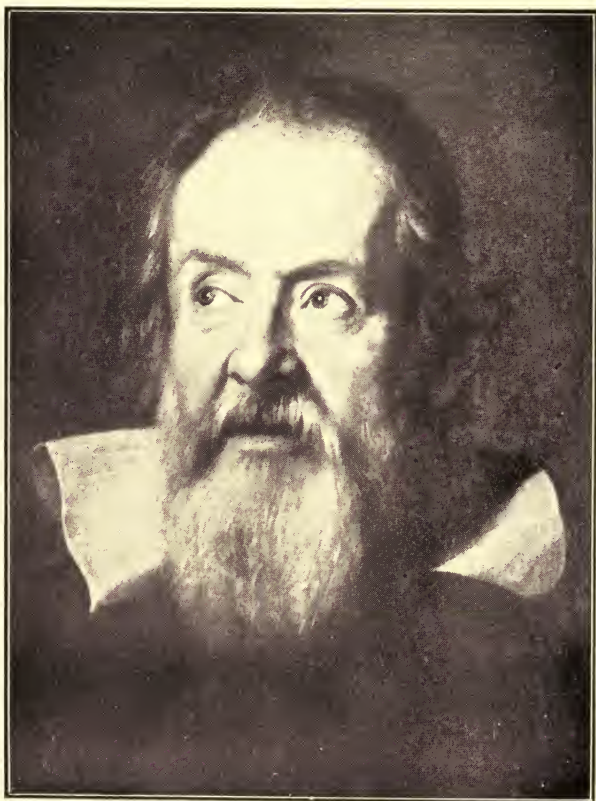
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CONTENTS

	PAGE
I. INTRODUCTION	9
II. FROM 1564 TO 1600	15
III. FROM 1600 TO 1616	22
IV. FROM 1617 TO 1632	37
V. FROM 1632 TO 1633	50
VI. FROM 1633 TO 1642	61
VII. REVIEW OF THE CASE	75
VIII. THE OPPOSITION NOT DISTINCTIVELY CATHOLIC	85
IX. THE CATHOLIC ATTITUDE	93
X. THE SAFER COURSE	103
XI. SUMMARY AND CONCLUSIONS	113
XII. ADDITIONAL NOTES :—	
I. Later History of the Decrees	121
II. Galileo's Proofs	126
III. Galileo's Contemporaries	129
IV. Kepler and Galileo	132
V. Works of Reference	134
VI. Postscript	135

NOTE

THE contents of this volume mainly appeared as editorial articles in *The Examiner* (Bombay) during 1912; the notes on Galileo's proofs and on his contemporaries (pp. 126-132) are by a contributor to *The Examiner*; the note on Kepler and Galileo (p. 132) was also partly contributed. The whole were published in book form in Bombay early in 1913; of this the present volume is a reprint, with a few necessary corrections.

August 1913.

GALILEO :

AND HIS CONDEMNATION

I. INTRODUCTION

THE condemnation of Galileo by the Roman Inquisition in 1633 is a subject from which any writer who aims at exciting interest would be most likely to abstain. The idea is that everybody is supposed to know all about it; and this may be one of the reasons why so many are privileged to talk nonsense and to display serious ignorance about it. The question having come before me lately, in the form of some rather misleading statements by a Catholic apologist, I thought it a good opportunity for investigating it with a view of checking these and other assertions and inferences which are current on the subject. Some of our popular writers on the Galileo question have not been happy in their treatment, apparently for want of familiarity with authentic documents. Hence the chief object was to reproduce their full text for reference in case of necessity. To give point to these documents they have been framed in a summary of the whole history drawn from reliable sources.

The use made of the Galileo case in the past differs considerably from that at the present time. Formerly, it was enlisted by Protestant controversialists as an argument against the infallibility of the Church and of the Pope. This line of argument is now obsolete except among the profoundly ignorant or the furiously fanatical. The open acknowledgement made by Catholics that a decree of the Inquisition or of the Index is not dogmatical but disciplinary—that even the approval and confirmation of a decree by the Pope does not make it an *ex cathedra* definition to which alone infallibility can be attached—has knocked the bottom out of this hackneyed accusation. In modern times the event is made use of, not so much by Protestants as by “progressive” Catholics, as a powerful object-lesson and warning held out to the official authorities at Rome, not to be precipitous in condemning modern scientific or critical theories. For since the Roman Congregations made a grievous mistake in Galileo’s case three centuries ago, so by passing an adverse sentence on the results of modern thought they might easily do the same again now. Such is the usual form of the argument.

The moral is of course a sound one, as nobody will deny. No doubt it does suggest caution, not only to Roman officials but to everybody else. But it is a lesson which has been sufficiently rubbed in; and it is perhaps a little superfluous, to say nothing of being offensive and ungracious, to make use of it

in the way which is done by some of the writers of the school referred to.

SUMMARY OF THE QUESTION

The great subject concerning which the name of Galileo has become a household word is, as everybody is supposed to know, the dynamic constitution of the universe—the point of contention being expressible in a nutshell thus : Whether the sun moves round the earth, or the earth moves round the sun?

The prevailing idea of primitive mankind pictured the world as a vast stationary plain with the ocean flowing round it, and the heavens either as a solid revolving dome which carried the sun, moon, and stars round with it; or else as a fixed dome under which the heavenly bodies revolved in concentric spheres of their own—the earth being the fixed centre of the system. *

The Greek philosopher Pythagoras (fl. B.C. 555) is traditionally said to have taught, on the contrary, that the earth, stars, and even the sun itself, were all moving bodies which revolved round a common centre called the “central fire”; but his teaching obtained no currency or acceptance.

Ptolemy (fl. A.D. 140), *the* great authority in astronomy throughout the Middle Ages, held that the earth was spherical; but in other respects he followed the ordinary idea that it was the fixed centre of the world and that the whole heavens revolved round it.

This last was the system in vogue till the time of Galileo. Before him, however, the Pythagorean idea had been revived by Nicolas de Cusa (died 1464) and developed by Copernicus (died 1543), who thought that the earth and all the planets revolved round the sun. His views were listened to with interest by Pope Clement VII., while his book treating of it was dedicated to Pope Paul III. Both these authors were good Catholics, and were in favour with the ecclesiastical authorities of the time. A third scientist, Tycho Brahe (born 1546), while admitting that the stars and planets revolved round the sun, still maintained against Copernicus that the sun revolved round the earth as the centre of the system. This view did not make much headway. Hence, at the time of Galileo there were only two rival systems to consider :

(1) The theory of Ptolemy, that the earth was the stationary centre, and that the sun, moon, and stars revolved round it [Geocentric system].

(2) The theory of Copernicus, that the sun was the stationary centre, and that the earth and all the other heavenly bodies revolved round it [Heliocentric system].

Galileo (born 1564) found the former system practically in universal vogue ; but his own discoveries soon convinced him that the second theory was the right one ; and he spared no pains to make his opinion known. Even on scientific grounds he suffered an incredible amount of opposition ; but

before long the question got entangled with theology. Galileo's theory was (1616 and 1633) condemned by the Church authorities, and Galileo himself was forced to renounce it under severe ecclesiastical pains and penalties. Yielding to outward pressure, but keeping his internal convictions to himself, he spent his latter years in disgrace, and died in the year 1642 at the age of seventy-eight, leaving posterity to vindicate the truth of his contentions, which are now a commonplace among the elements of scientific knowledge.

My original purpose in writing these chapters was simply to attend to this main issue, giving the historical facts in the barest outline, and paying chief attention to the official documents and the controversial aspects of the case. But while in the act of writing I came across a book on the subject which at once attracted attention and suggested a more comprehensive treatment. This volume casts a halo of human interest round the life of Galileo. Its title is *Galileo, his Life and Work*, by J. J. Fahie (Murray, 1903). The author is a professional engineer, and therefore shows a special interest in Galileo's scientific work. He has not confined himself to a dry narration, but has given us a vivid picture of Galileo as a man, and even of his intimate family relations—in short, a more entertaining book could hardly have been written. Moreover, though the author shows himself one-sided against Galileo's opponents and takes too favourable a view of Galileo's

own character and actions, the work is free from controversial animus.

The chief advantage of Fahie's book lies in the light it throws on the workings of the scientific and theological ethos which led to the Galilean tragedy. One of the great services of a historian is not merely to provide us with the facts, but also to reveal the psychological forces which lie at the back of them. By this means the strangest events in history become intelligible in the light of human nature, thus opening the modern mind to a more sympathetic and tolerant view of the past than would otherwise seem possible. For these reasons I decided to extend the scope of my treatment so as to set the whole question better in its historical context.

E. R. H.

II. FROM 1564 TO 1600

EARLY LIFE OF GALILEO

GALILEO was descended from a noble family of Florence honourably connected with the government of that republic. Vincenzo, the father of our Galileo, was an impoverished descendant of this family—of broken fortune, but intellectually well endowed; and a man of independent and critical mind. He had three sons: Galileo, Michelangelo, and Benedetto. The last of these died in infancy, while Michelangelo survived to be a constant source of domestic trouble to Galileo, and seems to have been a man of worthless character. Galileo himself was born in 1564 at Pisa. Here he received his early education, which included Greek and Latin. At the age of twelve or thirteen he joined the humanities class at the monastery of Vallombrosa near Florence, where he added the elements of logic and science to his classical studies. He even at one time thought of a religious life, and actually joined the novitiate of the order; but was withdrawn by his father, who wished him to engage in trade for the support of the family. Already he exhibited

a decided talent for mechanical invention by the making of toy machines, "none the less ingenious because they would not work." He was fond of music, and played the lute with taste. His skill in painting would probably have made him an artist had he been free to choose his own career. He was also fairly capable in the writing of verse. These varied abilities caused his father to abandon the scheme of turning him into a cloth-merchant. Instead of this the medical profession was decided upon; and so in 1581, at the age of seventeen, he was sent to study medicine at the university of Pisa.

Here in his philosophical course he displayed a propensity, inherited from his father, of always examining an assertion to see what it was worth, and soon acquired a reputation for bold contradiction which gave him the nickname of "the wrangler." His audacity reached its climax when he came to question the dictates of Aristotle, which was at that time regarded almost as a blasphemy. Medicine was practically neglected in favour of science and mathematics, and his insight soon led him to important results. The first of these was the invention of an instrument for timing the beats of the pulse. From the observation of a swinging lamp in church (so the story runs) he noticed that the oscillation of a pendulum constantly decreased in range but retained the same time for each oscillation. Experiments at home showed him that the time occupied by the swing varied according to the length of the

pendulum. Putting these two facts together, he constructed a pendulum with adjustable string measured by a scale. Applying this machine to a patient, the string was lengthened or shortened till the swings of the pendulum corresponded with the beats of the pulse, and the number on the scale was noted. Nowadays, the timing of the pulse is done simply by counting with a watch. But in those days watches hardly existed and clocks were not portable, and so the doctors had to estimate the pulse by guesswork till Galileo's instrument gave them an absolute measure.

SOME OF HIS DISCOVERIES

Vincenzio, meantime, finding that no progress was being made in medicine, withdrew his son from the university and kept him at home in Florence, where he studied science and mathematics to his heart's content. Inspired by the writings of Archimedes, he soon invented the "hydrostatic balance" for ascertaining accurately the weight of any two metals in an alloy. Suppose you send an ounce of pure gold to a goldsmith to make a ring with. The ring comes back and weighs exactly one ounce, but you have reason to suspect that he has withheld some of the gold and substituted the same weight of a baser metal. How can you detect the fraud? Gold is heavier bulk for bulk than any other metal which could have been used in its place. Therefore,

your procedure is as follows: You take another ounce of pure gold and immerse it in water, and see how much water it displaces. Next you immerse the ring and see how much water it displaces. If the displacements are equal you know that the ring is also of pure gold. If the ring displaces more, this proves that it has a greater bulk; or, in other words, that it is partly made up of a lighter metal.

This elementary fact was already known. But Galileo went further, and, by weighing the substances first in water and then in air, and instituting a comparison, he was able to find not only the presence of the alloy but also the amount in proportion to the whole.

Galileo's next work was to investigate the centre of gravity of bodies. These and other enterprises soon becoming known, gave Galileo a reputation and brought him an introduction to Ferdinando I., the Grand Duke of Tuscany, who henceforth became his patron. Meantime, Galileo's great problem was how to gain a living, as his inventions brought in no money. He therefore began to give private lessons in mathematics at Florence and Siena. Several tries to obtain a professorship at the university failed. When at last he succeeded in 1589 in securing an appointment for three years at Pisa, his salary only amounted to about £13 per annum—an office-boy's wage—which he managed to eke out by private tuition.

Meantime, his mind was never at rest. Besides

new researches into the centre of gravity, he discovered the cycloid curve. Hold a pencil point on the edge of a penny and roll the penny along a wall, and you will discover it too—and then you can go deeply into the mathematics of it as Galileo did. In 1590 he published a treatise, *De Motu Gravium*—"On the Movement of Heavy Bodies"—which was circulated in manuscript. In this treatise he appealed from the authority of Aristotle to the evidence of the senses, and by actual experiment proved certain of the principles of "the philosopher" to be false. The learned followers of Aristotle ridiculed and refused to listen to him; but Galileo tried to force them to face the fact. Aristotle's principle asserted that if two bodies of different weight were dropped together they would reach the ground in different times, the heavier one first. Galileo assembled the professors and students in the Campo Santo under the leaning tower of Pisa and dropped down a ten-pound shot and a one-pound shot at the same time. Instead of arriving at the ground separately they arrived together, and thus proved Aristotle wrong and Galileo right. No doubt the students put their tongues in their cheeks and began to splutter. But the grave professors went on maintaining that the ten-pound shot *must* travel ten times as fast as the one-pound shot, because Aristotle had said so, and they could quote chapter and verse. The only result was that Galileo was boycotted by his fellow-professors, and subjected to

so many petty annoyances that he retired from the university and returned to Florence in 1592. Here he left science alone for a time and devoted himself to literary criticism and the writing of verse. By this time his father had died, and the whole family—his mother, his brother the worthless Michelangelo, and two sisters—almost entirely depended upon him for their daily bread ; and he discredited and out of employment !

It was not long, however, before Galileo obtained a professorship in mathematics at Padua “for four years certain and two uncertain,” at a salary of 180 florins a year—which was exceptionally good. Here he wrote a number of treatises on military architecture, on fortification, on mechanics, on the sphere, on accelerated motion, and on gnomics. As an engineer he was in great requisition by the government, for whom he invented a new method of raising water. He also made a complicated geometrical and military compass. This soon secured a reputation, and brought in orders from all parts of Europe which he had to execute himself, and thus his house was turned into a workshop. Meantime, his reputation as a lecturer brought students flocking to Padua from other countries ; and on the expiry of his first term of years the appointment was renewed for another six.

Galileo never married ; but his relations with a Venetian lady named Marina Gamba brought him three children—Virginia (1600), Livia (1601), and

Vincenzio (1606). These were brought up by their mother at Padua till 1610, when they were withdrawn from her charge and taken by their father to Florence. In 1612, Marina—a person of violent temper, almost impossible to live with—married. Next year the two girls were put into a convent; the correspondence between them and their father provides charming reading. The boy's education was a drain on his father's slender purse, and he never made much of a career.

III. FROM 1600 TO 1616

GALILEO'S next work was the invention of the thermometer—which, however, only reached its perfection later. In 1604 his attention was turned to astronomy by the appearance of a new star, on the nature of which Galileo's speculations, though ingenious and novel, were not successful. They offended the Aristotelians, however, whose theory of the perfection and unchangeability of the heavens was outraged. It was this incident which first drew Galileo into controversy, in which he boldly threw down the gauntlet in favour of the Copernican system. So far, however, this theory was merely a speculative one. It was the discovery of the telescope which brought it within the range of experimental verification.

FRUITS OF THE TELESCOPE

This instrument was, it seems, first invented (or rather one might say discovered) in Holland in the year 1608 by an apprentice in a spectacle-shop, who happened to put two lenses together and found that they made distant objects look much nearer

and larger, but turned them upside down. His enterprising master seized on the discovery, fixed the double lenses in tubes, and began to sell them merely as curious toys, till the scientific value of the instrument was recognized and a patent taken out. Whether by independent thought, as he claimed, or by copying an instrument seen, as others say, Galileo soon succeeded in making one for himself. Turning this to the heavens, his first discovery was to perceive that the moon was a body very similar to the earth. By increasing the power of the instrument he next discovered Jupiter's moons and some new fixed stars, and found out something about the composition of the Milky Way. He announced these discoveries in a treatise published in 1610 under the title *Sidereus Nuntius*, which he presented together with a sample telescope to many of the princes and learned men of Italy, France, Flanders, and Germany. He did not in this book professedly connect his new discoveries with the Copernican theory ; but he made no secret of his belief in lectures and conversations. His treatise raised a new storm of hostility from the Aristotelians, some of whom even refused to look through his telescope, while others refuted his facts by *a priori* reasonings.

The next event was the discovery of the rings of Saturn, which, however, Galileo did not see as rings, but as smaller stars attached to the two sides of the orb, or, later on, as elliptical or triangular

projections. He was immensely puzzled when these projections gradually diminished and finally disappeared. This we now know to be due to the tilt of the rings, which periodically present their thin edge only to our view. To Galileo, the conclusion was that the two "satellites" had passed out of vision by revolving round their centre—the one being behind, the other in front of the planet's disc. It was only in 1656, after Galileo's time, that the true nature of Saturn's rings was ascertained, thanks to the increased power of Huygen's telescope.

In 1610 Galileo was appointed First Mathematician of the University of Pisa and Philosopher and Mathematician to the Grand Duke of Tuscany, Cosima II., with a yearly salary of 1000 scudi. His leaving Padua to reside at Florence in his new official capacity was a mistake, for it brought him into more immediate conflict with his enemies of the conservative school.

His next discovery was the varying crescent form of Venus, which afforded a strong confirmation of the Copernican theory—proving that this planet at least revolved round the sun.

In view of the widespread interest of these discoveries, Galileo in 1611 set out for the Eternal City: here he was received with the greatest distinction by princes and Church dignitaries, who vied with learned laymen in doing him honour. After an exhibition of his discoveries in the garden of the

Quirinal Palace, a commission of four scientific members of the Roman College was appointed at the request of Cardinal Bellarmine to examine and report. As a result the commissioners admitted what many had long denied and ridiculed, being fully convinced of the truth of the facts announced by Galileo. By this opinion, given on April 24th, 1612 (writes Fahie), his discoveries received to a certain extent the sanction of the Church. Attentions of all sorts were now heaped on him. Pope Paul V. granted him a long audience, and assured him of his unalterable good-will. High dignitaries of the Church followed suit and were lavish in their admiration; and the Accademia dei Lincei (the prototype of our Royal Society) elected him a member. So that when he took his departure, Galileo left behind him in Rome many sincere friends and admirers and some very envious foes.

Galileo's next discovery was that of spots on the sun, irregular and of changing shape, which travelled across the bright surface itself, and were certainly not separate planets. The Jesuit Father Scheiner, however, claimed independent discovery of these. As an amusing illustration of the way in which the teaching of Aristotle dominated the minds of the learned in those days, Fahie relates—though we have not been able to verify the story—that when Scheiner communicated his discoveries to his Provincial, the latter replied: “I have read Aristotle's writing from end to end many times, and I can assure you that I

have nowhere found anything similar to what you describe. Go my son, tranquillize yourself. Be assured that what you take for spots on the sun are the faults of your glasses, or your eyes." Scheiner was permitted to publish his observations, but only anonymously.

Another work written at this time was on the inequalities of the moon's surface, or "lunar mountains." A treatise on *Floating Bodies*, which appeared in 1612, soon raised a violent discussion. The view of Aristotle was that the floating or sinking of a body depended principally on its shape. This was based on the observation that a thin film of heavy material will float if laid gently on the surface of the water—the fallacy of which is exposed as soon as the film is immersed in the water. Into the experiments by which Galileo refuted the old theory we cannot enter; but his opponents remained unconvinced.

THE SCRIPTURE TROUBLE

It is in the year 1612 that we find the first symptoms of a gathering storm. So long as it was a question of Aristotle *versus* empirical observation not much mischief could arise. But when his adversaries found themselves worsted in argument by the appeal to facts, they fell back on a more dangerous weapon which they wielded with deadly effect. They began to take their stand on theology, and to declare that Galileo's astronomical doctrines

were contrary to Scripture, and that the Church was therefore in danger.

It is sometimes supposed that Galileo brought all the mischief on himself by dabbling in theology; that had he confined himself to science and left Scripture alone he would never have come to grief. But it looks as if the Scriptural question was first raised by Galileo's enemies, and he was simply forced to argue the subject in self-defence. The first ground of contention was his theory of sun-spots: this raised an immense amount of *odium theologicum* at Pisa, at the very time when Cardinal Maffeo Barberino (afterwards Pope Urban VIII.) and others at Rome were thanking Galileo for a copy of his book, and expressing their admiration at his researches. The real trouble seems to have arisen out of a simple incident. The Dowager Duchess of Tuscany, in a conversation with a disciple of Galileo, the Benedictine Father Castelli, raised the objection that the double motion of the earth seemed contrary to Scripture. When informed of this Galileo wrote a letter to Castelli maintaining the view expressed in recent years by Leo XIII., "that the Scripture, not having for its object to teach science, makes use of such expressions as would be intelligible to the vulgar without regard to the true structure of the heavens." The enthusiastic Castelli gave this letter a wide circulation in written copies: it thus came into the hands of Galileo's enemies, who exaggerated his modest contention into a

charge of having assailed the universal authority of the Bible.

After some months of agitation behind the scenes, Father Caccini, of the Dominican convent of San Marco, openly declared war in the pulpit of one of the Florence churches (December 1614), asserting that Galileo's doctrine of the earth's motion round the sun was irreconcilable with the Catholic Faith, since it contradicted Holy Scripture. He therefore denounced Galileo's teaching as heretical. A Jesuit Father, preaching shortly after at the Duomo (or Cathedral), took up Galileo's cause against the Dominican, stating that Copernicus was right, that Galileo and his followers were good Catholics, and that his enemies were ignorant of science. This contention between the representatives of the two famous orders only added fuel to fire, and provoked more business-like measures. Father Lorini, a Dominican of the same convent, under date February 5th, 1615, drafted to the Holy Office of the Inquisition at Rome a denunciation—not of Galileo by name, but of the Galileists in general, who maintained that the earth moves and the heavens stand still; and passed a severe theological censure on Galileo's letter, a copy of which was enclosed.

On receipt of this denunciation the Holy Office instituted a private inquiry. The Counsellor's report was a colourless one. Some passages were objectionable; but though at first sight they looked ill, they were capable of being taken in a good sense, and,

on the whole, the document did not deviate from Catholic doctrine. In other words, the sober and sound view of Leo XIII. in the nineteenth century was also the view accepted on this occasion by the Holy Office in the early seventeenth. The only notice taken of the denunciation was a private and unofficial note from a friend in Rome—apparently inspired by Cardinals del Monte and Bellarmine—advising Galileo to hurry on with his promised further writings on the same subject, but cautiously to avoid theology and confine himself to mathematics and physics. “Write freely,” he said, “but be careful to keep outside the sacristy.” Galileo also received private assurances from Cardinal Barberini (afterwards Pope Urban VIII.) that he had Galileo’s interests at heart, and imposing the same caution about theology. Galileo, unfortunately, was indiscreet enough—though the step was quite human and natural—to go to the source of the mischief and write a sort of *apologia* to the Grand Dowager Duchess who had originally raised the objection, explaining his views about Scripture in a modest and deprecatory manner. This letter did not convert the Duchess, and merely gave another handle to Galileo’s enemies.

Hearing ominous reports that agitation was still going on, Galileo thought it best to combat his enemies by going to Rome in person, which he did in December 1615. His reception by the authorities was cordial, but he soon discovered that a zealous

movement was going on against him even in Rome itself. Caccini, who had also come to Rome, held a private discussion with Galileo, but without converting him from his novel views.

THE OFFICIAL ACT OF 1616

Meantime, the official machinery was set to work. On the 19th of February the Qualifiers or experts of the Holy Office were called upon for an opinion on the following propositions extracted from Galileo's work on sun-spots :—

(1) The sun is the centre of the world, and therefore immovable from its place.

(2) The earth is not the centre of the world, and is not immovable, but moves, and also with a diurnal motion.

On February 24th, the Qualifiers sent in their verdict as follows :—

(1) "The proposition that the sun is the centre of the world and does not move from its place is absurd and false philosophically, and formally heretical because it is expressly contrary to Holy Scripture.

(2) "The proposition that the earth is not the centre of the world and immovable, but that it moves, and also with a diurnal motion, is equally absurd and false philosophically, and, theologically considered, at least erroneous in faith."

In view of this verdict of the consulting theologians,

the Pope desired Cardinal Bellarmine to send for Galileo and admonish him to abandon his opinion ; and if he refused to obey, the Father Commissary in the presence of a notary and witnesses was to enjoin on him a command to abstain altogether from teaching or defending this opinion and doctrine, and even from discussing it ; and if he did not acquiesce therein, that he should be imprisoned.

There exists in the Roman archives a document purporting to record this admonition. It is dated February 26th [1616], but bears no signature :—

“Friday, the 26th. At the palace, the usual residence of the Lord Cardinal Bellarmine, the said Galileo, having been summoned and brought before the said Lord Cardinal, was, in presence of the Most Revd. Michelangelo Seghizzi, of the order of preachers, Commissary-General of the Holy Office, warned by the said Lord Cardinal of the error of the aforesaid opinion and admonished to abandon it. And immediately thereafter before me and before witnesses, the Lord Cardinal Bellarmine being still present, the said Galileo was by the said Commissary commanded and enjoined, in the name of his Holiness the Pope, and the whole Congregation of the Holy Office, to relinquish altogether the said opinion that the sun is the centre of the world, and immovable, and that the earth moves ; nor henceforth to hold, teach, or defend it in any way whatsoever, verbally or in writing ; otherwise proceedings would be taken against him in the Holy Office ; which

injunction the said Galileo acquiesced in and promised to obey.

“Done at Rome, in the palace aforesaid, in the presence of Badino Nores, of Nicosia, in the kingdom of Cyprus, and Augustino Mongardo, from a place in the abbacy of Rose, in the diocese of Politianeti, inmates of the said Cardinal’s house, witnesses.”¹

This submission saved him from official censure, and conciliated those who had to judge about his case; for when in March an official decree of the Index was issued prohibiting five works on the subject, those of Galileo were considerably not mentioned among them. The text of this famous decree, dated March 3rd, 1616, runs as follows:—

“March 3, 1616. The Lord Cardinal Bellarmine having reported that Galileo Galilei, mathematician, had, in terms of the order of the Holy Congregation, been admonished to abandon the opinion he has hitherto held, and had acquiesced therein; and the decree of the Congregation of the Index having been presented, prohibiting and suspending respectively the writings of Nicolas Copernicus on *The Revolutions of the Celestial Orbs*; of Diego di Zuniga *On Job*; and of Paola Antonio Foscarini, Carmelite

¹ A controversy was raised as to whether this document of February 26th is genuine or a forgery. That some such interview took place is proved by the decree of March 3rd which immediately follows; the only question is whether this is an authentic account of it. No reference to this document occurs till 1632, when it was used with deadly effect. The latest authorities are, however, in favour of its genuineness.

friar ; his Holiness has ordered this edict of prohibition and suspension respectively to be published as follows :—

“ . . . And whereas it has also come to the knowledge of the said Congregation, that the Pythagorean doctrine—which is false and altogether opposed to Holy Scripture—of the motion of the earth, and the quiescence of the sun, which is also taught by Nicolas Copernicus in *De Revolutionibus Orbium Coelestium*, and by Diego di Zuniga in [his book on] Job, is now being spread abroad and accepted by many—as may be seen from a certain letter of a Carmelite Father, entitled, *Letter of the Rev. Father Paola Antonio Foscarini, Carmelite, on the opinion of the Pythagoreans and of Copernicus concerning the motion of the earth, and the stability of the sun, and the new Pythagorean system of the world, at Naples, printed by Lazzaro Scorriggio, 1615* : wherein the said father attempts to show that the aforesaid doctrine of the quiescence of the sun in the centre of the world, and of the earth's motion, is consonant with truth and is not opposed to Holy Scripture. Therefore, in order that this opinion may not insinuate itself any further to the prejudice of Catholic truth, the Holy Congregation has decreed that the said Nicolas Copernicus, *De Revolutionibus Orbium*, and Diego di Zuniga, on Job, be suspended until they be corrected ; but that the book of the Carmelite Father, Paola Antonio Foscarini, be altogether prohibited and condemned, and that all

other works likewise, in which the same is taught, be prohibited, as by this present decree it prohibits, condemns, and suspends them all respectively. In witness whereof the present decree has been signed and sealed with the hands and with the seal of the most Eminent and Reverend Lord Cardinal of St. Cecilia, Bishop of Albano, on the 5th day of March, 1616."

In this decree a distinction is made between those works which assert the Copernican system as an ascertained fact, and those which treat it as a tentative suggestion or hypothesis. The former are absolutely condemned, the latter merely ordered to be emended.¹ Galileo's works were not mentioned; nor was he called upon to abjure his views; and when the rumour got about that he had been made to recant and had received a salutary penance, Cardinal Bellarmine gave him a certificate (dated May 26th, 1616) formally declaring that this was not the case :—

"We, Robert Cardinal Bellarmine, having heard that it is calumniously reported that Signor Galileo Galilei has in our hand abjured, and has also been punished with salutary penance, and being requested to state the truth as to this, declare that the said Signor Galileo Galilei has not abjured, either in our

¹ In 1620 appeared a *monitum* of the Index permitting the reading of the work of Copernicus after certain specified corrections had been made. These corrections, according to Fahie, were of a most trivial character.

hand or the hand of any other person here in Rome, or anywhere else, so far as we know, any opinion or doctrine held by him; neither has any salutary penance been imposed upon him, but only the declaration made by the Holy Father, and published by the Sacred Congregation of the Index, has been intimated to him, wherein it is set forth that the doctrine attributed to Copernicus—that the earth moves round the sun, and that the sun is stationary in the centre of the world, and does not move from east to west—is contrary to the Holy Scriptures, and therefore cannot be defended or held.

“In witness whereof, we have written and subscribed these presents with our hand this 26th day of May, 1616.”

According to this, Galileo received no official prohibition, but only the Cardinal's private admonition not to defend or hold the Copernican doctrine. It is said that on March 11th, a week after the decree had been issued, Galileo had an interview with Pope Paul V., in which he assured the Pope of the rectitude of his intentions and complained of the persecution of his adversaries. Paul V. answered very kindly, stating that both himself and the Cardinals of the Index had formed the highest opinion of him and did not believe his calumniators.

Cardinal de Monte also wrote to the Grand Duke to bear witness that Galileo was leaving Rome with the best reputation and the approval of all who

have had transactions with him ; for it had been made manifest how unjust were the calumnies of his enemies. It seems, however, that Galileo's aggressiveness of manner was likely to do him harm, and so he was recalled at once to Florence.

IV. FROM 1617 TO 1632

THUS closed the first episode of the Galilean tragedy. What will puzzle the reader is the apparent discrepancy between the unofficial favour which was shown to Galileo's theories by popes and cardinals, and the official stand taken against the same by the Congregations—especially as their proceedings were known to the Pope and ordered by him to be published. This seeming inconsistency becomes intelligible if we view it in the light of a compromise between two parties. The favour in which Galileo was held by one section explains why Galileo himself and his writings should be spared the stigma of nominal condemnation. On the other hand, the alarmist cry about faith and the Scriptures had to be met ; and this was done by the censure of certain other books containing the same theory, and by the announcement that Galileo had been ordered to abandon his view and had acquiesced. The official assertion that the Pythagorean theory was "false and altogether opposed to Scripture," though objectively wrong, is at least excusable and explainable on subjective grounds, namely, that the

theologians of that day were immovably convinced of the soundness of their traditional interpretation ; and quite probably those who acted as theological experts were not at the same time scientific experts, or, if such, they had remained entirely unconvinced by the arguments of Galileo. Nor can it be claimed in that early stage of investigations that the new theory was irrefragably demonstrated. The officials of the time, it seems, did not object to the new theory being proposed *as a hypothesis*. This is shown by the fact that when in 1620 the correction of the book of Copernicus was undertaken by Cardinal Gaetani, the changes made were of the most trivial character—after which it was allowable to read the book, and its doctrines could be held by the faithful *ex hypothesi* and “without affirming anything.” This official action four years later is a tacit acknowledgement that the condemnation of the Pythagorean theory as “false and altogether opposed to Scripture” was an exaggeration.

FURTHER DISCOVERIES

On his return to Florence, Galileo devoted fresh attention to the flux and reflux of the tides. No one at that time had the least notion that these movements were due to attraction of the moon. Galileo himself went on a wrong scent altogether, and worked out of the tides a false argument in favour of the Copernican theory, regarding them as

the visible effects of the twofold movement of the earth.

More solid work was done on Jupiter's satellites. Galileo, after six years' observation, thought that their positions could be utilised by sailors as a means of measuring longitude; and he opened negotiations with the Court of Spain in the hope of winning a prize of 1000 crowns which had been offered for any successful method. His system, however, was so beset with difficulties that it never came into use.

IL SAGGIATORE

In August 1612, when three comets appeared in the sky, Galileo's explanation of them had been that they were not heavenly bodies but atmospheric condensations. On account of ill health he allowed his views to be put forth by a disciple, and it was only in 1622 that he wrote on the subject himself, in a work called *Il Saggiatore*—"The Assayer." The MS. was sent to Mgr. Cesarini in Rome, and for five months was handed round among the members of the Accademia dei Lincei, who examined it carefully and (with the author's consent) altered some passages which might have given a handle to his enemies. The papal *imprimatur* was given in February 1623.

While this work was in the press Cardinal Barberini succeeded to the papal throne (Aug. 8, 1623) under the title of Urban VIII. This was

tidings of great joy to Galileo. His friendship for Galileo while cardinal has already been noted. Several letters are extant which reveal his appreciation of Galileo's talents and discoveries ; and in the episode of 1616 his influence with Pope Paul V. had done much to extricate Galileo from his difficulties. We shall see later on the causes which turned this friend into a foe.

Il Saggiatore was published in 1623, with a dedication to Pope Urban VIII., who was delighted with the book, and had it read to him aloud at table. In it Galileo displayed, perhaps, more self-restraint in treating his opponents than was usual with him ; but the combined wit and pungency of his arguments only intensified the bitterness of his enemies, who were always exhibited in the most sorry light. As a specimen of Galileo's cutting style, it will refresh our readers to peruse the following extract.

Sarsi had quoted a story from Suidas (in support of his argument that motion always produces heat) to the effect that the Babylonians used to cook their eggs by whirling them in a sling. To this Galileo replied :—

“ I cannot refrain from marvelling that Sarsi will persist in proving to me, by authorities, that which at any moment I can bring to the test of experiment. We examine witnesses in things which are doubtful, past, and not permanent, but not in those things which are done in our presence. If discussing a difficult problem were like carrying a weight,

since several horses will carry more sacks of corn than one alone will, I would agree that many reasoners avail more than one ; but discoursing is like coursing, and not like carrying, and one barb by himself will run farther than a hundred Friesland horses. When Sarsi brings up such a multitude of authors, it does not seem to me that he in the least degree strengthens his own conclusions, but he ennobles the cause of Signor Mario and myself, by showing that we reason better than many men of established reputation. If Sarsi insists that I must believe, on Suidas's credit, that the Babylonians cooked eggs by swiftly whirling them in a sling, I will believe it ; but I must say, that the cause of such an effect is very remote from that to which it is attributed, and to find the true cause I shall reason thus :—If an effect does not follow with us which followed with others at another time, it is because, in our experiment, something is wanting which was the cause of the former success ; and if only one thing is wanting to us, that one thing is the true cause. Now, we have eggs, and slings, and strong men to whirl them, and yet they will not become cooked ; nay, if they were hot at first, they more quickly become cold ; and since nothing is wanting to us but to be Babylonians, it follows that being Babylonians is the true cause why the eggs became cooked and not the friction of the air, which is what I wish to prove. Is it possible that in travelling post, Sarsi has never noticed what freshness is

occasioned on the face by the continual change of air? and if he has felt it, will he rather trust the relation by others of what was done two thousand years ago at Babylon, than what he can at this moment verify in his own person? I, at least, will not be so wilfully wrong, and so ungrateful to nature and to God that, having been gifted with sense and language, I should voluntarily set less value on such great endowments than on the fallacies of a fellow-man, and blindly and blunderingly believe whatever I hear, and barter the freedom of my intellect for slavery to one as liable to error as myself."

Early in 1625, the book was anonymously denounced to the Inquisition as being a veiled defence of the Copernican doctrines; and a movement was begun to prohibit it, or at least to have it corrected. But the attempt failed. The General of the Theatines, to whom it was submitted for examination, reported most favourably of it; remarking that even if the doctrine of the earth's motion had been maintained, this would not be a sufficient reason for condemning it.

GALILEO AND URBAN VIII

On the accession of Urban VIII., Galileo had conceived the plan of going to Rome to present his congratulations in person. After a delay on account of sickness, he at last set out in 1624. He had no fewer than six interviews with the new Pôpe, who received him affably and heard his arguments in

support of the Copernican theory. What change had come over Barberini's mind is not clear. Perhaps his sense of official responsibility in view of the attitude of the Inquisition explains everything. But at anyrate he merely listened to Galileo without favouring his views, and would not dream of revoking the decree of 1616. He contented himself with heaping personal favours on Galileo, and with writing to the Grand Duke a long appreciation of Galileo's services to science, and of his religious spirit.

Thus disappointed, Galileo returned to Florence and devoted himself to the improvement of the microscope, of which he distributed specimens. He next wrote a reply to an attack on the Copernican system which had been addressed to him in the year 1616. Though he astutely professed to treat the matter as a theory only and not as a fact, his friends advised him not to publish it. He, therefore, merely sent it round in MS. ; and when certain passages were culled from it and sent to Urban VIII., the Pope, instead of condemning them, expressed his highest approval. It even appeared that when Cardinal Zollern in 1624 represented that all the heretics of Europe considered the truth of the Copernican theory beyond doubt, and therefore it would be necessary to be very circumspect in coming to any resolution upon it, His Holiness replied that the Church had not condemned it, nor was it to be condemned as heretical, but only as rash ; adding, however, that there was no fear of anyone under-

taking to prove that it must be true. These and other indications tended to confirm Galileo in the view that under the pontificate of Urban VIII. Copernicanism had little to fear, provided the defence was handled so carefully as not to outrage the decree of 1616. Under this impression (which proved to be a mistaken one) Galileo undertook his great *Dialogue on the Two Principal Systems of the World*, which occupied him for several years.

THE "DIALOGUE"

In the beginning of the year 1630 he had completed the text of the *Dialogue*, and proposed to go to Rome in person to get it printed there. His hopes were increased by hearing the following incident :—A Dominican friar had been on the point of converting certain German nobles to the Church ; but when they heard of the prohibition of the Copernican theory they were entirely repelled. On learning this Pope Urban VIII. replied : "It was never our intention, and, if it had depended on us, that decree would not have been passed." This encouraged Galileo to set out for Rome, where he had a long audience with the Pope about his book. His Holiness would not object to the publication, but certain conditions would have to be fulfilled. The title must indicate that it is a frank discussion of the merits of the Copernican and Ptolemaic systems ; the subject must be treated from a purely hypo-

thetical standpoint, and this must be set forth in the preface. Finally, the book must conclude with an argument which Urban VIII. himself had communicated to Galileo in 1624, and which His Holiness considered unanswerable. This argument ran as follows:—"God is all powerful; all things are therefore possible to him. Therefore the tides cannot be adduced as a *necessary* proof of the double motion of the earth without limiting God's omnipotence—which is absurd."

Galileo, rather than forgo the publication of his work, accepted these conditions. The MS. was submitted to the papal censor and then to his assistant, who went carefully through it, altered many passages, and finally approved the work thus revised. The *Imprimatur* was then given for publication in Rome, on the understanding that a preface and conclusions should be added in accordance with the Pope's wishes. Being hindered by sundry delays from printing the work in Rome, he arranged to have it done in Florence, and suggested that the revision should also be carried out there. This being agreed to, the work finally appeared in February 1632. Presentation copies were sent to Rome and read with applause in some quarters, but with consternation among Galileo's enemies—and also among some of his friends. Various attempts were made to fix discredit on the book, and at last it was noticed that the "weighty argument" of the Pope, at the conclusion, had been put in the mouth of

Simplicio—the inference being that by Simplicio no other was intended than the Pope himself. Simplicio—one of the three among whom the *Dialogue* is distributed—is really the simpleton of the book, who is constantly made a laughing-stock to the reader on account of the *naïveté* of his arguments and the facetious way in which they are refuted.

THE POPE ALIENATED

Now, it seems to us utterly incredible that Galileo would consciously do such a foolish thing as to make fun of the Pope, in a work the very publication and acceptability of which depended upon his personal favour. But it is wonderful how easy it is to poison the mind; and how easy, when the mind is poisoned, to find incrimination in the most innocent things. The Pope, we are told, was fearfully angry. Being in this condition, it would be easy for the enemies of Galileo to work on his feelings, and persuade him that the Copernican doctrine ran counter to the Catholic faith and that the *Dialogues* would therefore do incalculable harm to the Church. They went further, and tried to make out that Galileo had in a veiled manner dared once more to interpret Holy Scripture; that, therefore, he was contumacious to authority; and finally, that he had secured the *Imprimatur* by cunning devices.

According to Fahie, this idea of a personal insult to the Pope is the real key to the puzzle; the ex-

planation of the severe treatment which Galileo subsequently received at the hands of the Inquisition ; and the real reason why the Pope, who had hitherto been so favourable to Galileo, now turned against him. Fahie, however, puts the matter too strongly when he says that in the subsequent proceedings against Galileo the Pope's "revenge for a personal insult" was the primary and determining factor. We consider this too strong, not because we are bound in any way to defend the reputation of Urban VIII. in this matter, but simply because we think the explanation superficial in point of psychology. As far as we can gather, Urban VIII. had no very strong convictions in science, nor was he noted as a keen theologian. Galileo wrote of him in 1624 that "as to the truth or falsehood of the theory, he accepts neither Ptolemy nor Copernicus, but rather believes that the heavenly bodies are moved and regulated by angels without difficulty or entanglement." But a man in his position as head of the Church is not altogether free to follow his own personal views. He is surrounded by advisers and conditioned by a large apparatus of official departments, in whose competency he must place confidence. The free and independent opinions of individuals in favour of the Galilean doctrines could never have the same weight with him as the verdict of his departmental specialists ; and it is certain that the preponderance of opinion in ecclesiastical ranks was on the conservative side and dead against the

innovations of Copernicanism. The severe view was already embodied in the official decree of 1616, and this he evidently felt bound to uphold until convincing reasons were brought forward to the contrary. His own want of personal conviction led him, as we have seen, out of motives of expediency, to minimise the import of this decree when it was a question of the edification or disedification of outsiders; but when within the fold itself he found any man ignoring the decree and acting contrary to it, and especially betraying a spirit of contempt for authority, the same motive of expediency would naturally lead him to sanction severity of treatment, if its desirability were strongly urged upon him by the importunities of influential persons. Such elasticity of administration is common to all rulership and is not peculiar to the Court of Rome. Consequently, it would not need much to turn Urban's easy, good-natured policy of previous years into a policy of disciplinary sharpness as soon as he discovered signs of a contumacious spirit. No doubt the insinuation of a personal insult may have been one of the factors of the change—for it is far easier to adopt drastic measures with persons out of favour than with persons in favour. But it is quite possible that, quite apart from his personal feelings, the Pope was beginning conscientiously to regard Galileo as a *dyskolos* or unmanageable subject, and thus sanctioned and even threw himself into the adverse movement, with the view of teaching Galileo himself and others

of the same temper a salutary lesson of submission. Still, however favourable our speculations may be as to the uprightness of the Pope's motives, it is certainly acknowledged, even by Catholic writers, that the accusation of "poking fun at the Pope" did alienate the sympathies of one who had been hitherto the philosopher's friend, and who otherwise might once more have tided him over his new difficulties.

V. FROM 1632 TO 1633

GALILEO, meantime, quite unaware of the turn affairs had taken in Rome, was just in the heyday of his rejoicings at the success of his book, when suddenly his publisher, Landini, received instructions forbidding the sale of the *Dialogues*. A few days later a special commission was appointed in Rome, by order of the Pope, under the presidency of his nephew, Cardinal F. Barberini, and composed of Jesuits, Dominicans, and Theatines. In answer to Galileo's appeal for protection, the Duke wrote to Rome asking that the accusations should be sent to Florence so as to give Galileo a chance of defending himself. To this demand the Pope answered the Duke's messenger: "Your Galileo has dared to meddle in things that he ought to have left alone; in fact, with the most important and dangerous things that can be stirred up in these days." When it was requested that at least the charges might be communicated to Galileo, the Pope answered; "Galileo knows well enough in what way he has transgressed. In these matters of the Holy Office, nothing is ever done but to pronounce judgement, and then summon to recant."

After a month's sitting the special commission submitted a long report to the Pope. After recounting the negotiations for printing the work, three accusations are made against the author :—

“ 1. Galileo has transgressed orders in deviating from the hypothetical standpoint, by maintaining decidedly that the earth moves and that the sun is stationary.

“ 2. He has erroneously ascribed the phenomena of the tides to the stability of the sun and the motion of the earth, which is not true.

“ 3. He has been deceitfully silent about the command laid upon him in 1616, viz. to relinquish altogether the opinion that the sun is the centre of the world and immovable, and that the earth moves : nor henceforth to hold, teach, or defend it in any way whatsoever, verbally or in writing.”

Then follows the remark : “ It now remains to be considered what proceedings are to be taken against the person of the author, and against his printed book.” The rest of the document is taken up with an elaboration of the charges against Galileo, and a fuller account of the negotiations for the *Imprimatur*.

The accusation No. 3 evidently harks back to the document of 26th February, 1616, the genuineness of which has been called in question. Fahie lays great stress on this point, especially as Galileo himself, later on, disavowed all remembrance of any such injunction. Those who hold the injunction to be

genuine will, however, find here nothing but a convenient *lapsus memoriæ*.

A few days later the Pope sent word to the Tuscan ambassador that Galileo's affairs would be handed over to the Inquisition. On 23rd September the following order was issued :—

“ His Holiness charges the Inquisitor at Florence to inform Galileo, in the name of the Holy Office, that he is to appear in the course of the month of October, in Rome, before the Commissary-General. He must obtain a promise from Galileo to obey this order, which the Inquisitor is to deliver in the presence of a notary and witnesses, but in such a way that Galileo shall know nothing of their presence, so that if he refuse to obey they may bear witness to his contumacy.”

On 19th November Galileo was summoned before the Inquisitor at Florence, and the order was communicated to him in the manner prescribed. Galileo, whose health had been failing for some years back, pleaded incapacity for travel, and procured a medical certificate to that effect. On 30th December there came a papal order which brooked no delay ; so on 20th January 1633 he set out in the grand-ducal litter, accompanied by a doctor, and reached Rome on 13th February. The favour was asked for and granted that he should be lodged at the house of the Tuscan ambassador instead of the prison of the Inquisition. Weeks passed and nothing more occurred, the Holy Office being engaged with the

preliminaries. Galileo, meantime, was preparing his own defence; but, on the advice of his friends, in view of the strong bias against him, he finally gave up all idea of opposition and resolved on entire submission.

THE INQUISITION PROCESS

On 12th April 1633 Galileo appeared for his first examination before the Commissary-General of the Inquisition. On being asked about the admonition he had received in 1616, his answers showed that he only knew that of Cardinal Bellarmine mentioned in the certificate of 26th May 1616; and he avowed his total unconsciousness of any stringent command such as that contained in the official document of 26th February. For the rest, Galileo declared he did not consider that in writing his book he had acted contrary to, still less disobeyed, the command not to hold or defend the opinions in question. "I have never either maintained or defended the opinion that the earth moves and that the sun is stationary, but have demonstrated the opposite, and shown that the arguments of Copernicus are weak and inconclusive." This statement is of course manifestly evasive. It is notorious throughout the history that Galileo was the great champion of the Copernican theory, and that his constant aim was to demonstrate that doctrine and to refute the contrary theory. In conversation he never made any secret of his con-

victions ; and the attitude assumed in his writings was never anything but a dodge to evade the attacks of his enemies. This was, moreover, perfectly well known to everybody ; and so Galileo's protestation that he had never held or defended that doctrine must be regarded as a dissimulation due to the official pressure which was put upon him, justifiable only in the technical sense of the plea of " not guilty."

Three days later, on 15th April, the Counsellors of the Holy Office delivered their opinions on the case : (1) That the *Dialogues* did maintain the doctrine that the earth moves and that the sun is stationary ; (2) that Galileo not only taught this doctrine but held it personally even to this day ; (3) that the publication of the *Dialogues* was an infringement of the order of 1616.

The second examination, which took place on 30th April, reveals a total change of front on the part of Galileo, who now, instead of repeating his previous denials, spontaneously acknowledged that he had defended these doctrines. The explanation was that in the interim he had been visited privately by the Commissary-General and persuaded to make a clean breast of his fault as the only chance of appealing to the mercy of the Court. Time was permitted to him to prepare a formal statement ; and so, on the 30th, when asked what he had to say, Galileo proceeded to make the following abject and humiliating confession :—

“In the course of some days’ continuous and attentive reflection on the interrogations put to me on the 12th of the present month, and in particular as to whether sixteen years ago an injunction was intimated to me by order of the Holy Office forbidding me to hold, defend, or teach, in any manner, the opinion that had just been condemned—of the motion of the earth and the stability of the sun—it occurred to me to reperuse my printed *Dialogues* (which for three years I had not seen), in order carefully to note whether, contrary to my most sincere intention, there had by any inadvertence fallen from my pen anything from which a reader or the authorities might infer not only some taint of disobedience on my part, but also other particulars which might induce the belief that I had contravened the orders of Holy Church. And being by the kind permission of the authorities at liberty to send about my servant, I succeeded in procuring a copy of my book, and having procured it I applied myself with the utmost diligence to its perusal and to a most minute consideration thereof. And, owing to my not having seen it for so long, it presented itself to me as if it were a new writing and by another author. I freely confess that in several places it seemed to me set forth in such a form that a reader ignorant of my real purpose might have had reason to suppose that the arguments adduced on the false side, and which it was my intention to refute, were so expressed as to

be calculated rather to compel conviction by their cogency than to be easy of refutation. Two arguments there are in particular—the one taken from the sun-spots, the other from the ebb and flow of the tide—which in truth come to the ear of the reader with far greater show of force and power than ought to have been imparted to them by one who regarded them as inconclusive and who intended to refute them; as, indeed, I truly and sincerely held and do hold them to be inconclusive and admitting of refutation. And as excuse to myself for having fallen into an error so foreign to my intention, not contenting myself merely with saying that when a man recites the arguments of the opposite side with the object of refuting them, he should, especially if writing in the form of dialogue, state them in their strictest form, and should not cloak them to the disadvantage of his opponent;—not contenting myself with saying this, I now see I was misled by that natural complacency which every man feels with regard to his own subtleties, and in showing himself more skilful than the generality of men in devising, even in favour of false propositions, ingenious and plausible arguments. However, although with Cicero *avidior sim gloriæ quam satis est*, if I had now to set forth the same reasonings, without doubt I should so weaken them that they should not be able to make an apparent show of force of which they are really and essentially devoid. My error, then, has been—

and I confess it—one of vainglorious ambition and of pure ignorance and inadvertence.

“This is what occurs to me to say with reference to this particular, and what suggested itself to me during the reperusal of my book.”

After making this humiliating declaration, Galileo was allowed to withdraw, and no questions were put to him ; but he must have concluded from this silence or other signs that he had not gone far enough in the denial of his inmost convictions ; perhaps this penitent acknowledgement of error and vainglory was not sufficient, and the Inquisitors would be conciliated by the resolution to publicly correct his error. Whatever prompted the impulse, he returned at once to the Court and spoke as follows :—

“And in confirmation of my assertion, that I have not held and do not hold as true the opinion which has been condemned, if there shall be granted to me, as I desire, means and time to make a clearer demonstration thereof, I am ready to do so ; and there is a favourable opportunity for this, seeing that in the work the interlocutors agree to meet again after a certain time, to discuss several distinct problems of nature connected with the matter discussed at their meetings. As this affords me an opportunity of adding one or two other ‘days,’ I promise to take up the arguments already adduced in favour of the said opinion, which is false and has been condemned, and to confute them in such

most effectual manner as by the blessing of God will be possible to me. I pray, therefore, this sacred tribunal to aid me in this good resolution, and to enable me to put it into effect."

Galileo was allowed to return to the Tuscan Embassy, on oath not to leave it, not to hold intercourse with anybody, to present himself to the Holy Office when summoned, and to maintain strict silence about the trial.

On 10th May Galileo appeared before the Inquisition for the third time. Being allowed to prepare a defence, he at once handed in a paper already written, in which among other concessions—clearly made under moral pressure—he admits that he had received a strict injunction in 1616, making excuses to explain why he had not mentioned it in applying for the *Imprimatur* in 1630. The document concludes as follows :—

"Lastly, it remains for me to pray you to take into consideration my pitiable state of bodily indisposition, to which at the age of seventy years I have been reduced by ten months of constant mental anxiety, and the fatigue of a long and toilsome journey at the most inclement season, together with the loss of the greater part of the years of which, from my previous condition of health, I had the prospect. I am encouraged to ask this indulgence by the clemency and goodness of the most eminent lords, my judges, and hope that they will be pleased to remit what may appear good to their entire

justice, and to consider my sufferings as adequate punishment."

To such a pass of abjection had the free and independent spirit of Galileo been at length reduced ! —for it seems clear that the whole of his attitude in this matter was one of yielding, against his own intimate convictions, to forces which he found himself utterly unable to resist.

On 16th June, at a private meeting of the Congregation, over which the Pope presided, it was decreed to try Galileo as to his intention under threat of torture ; and if this failed, he was then to be called upon to recant before a full assembly of the Holy Office, to be condemned to imprisonment at their pleasure, and to be forbidden to discuss either in writing or speaking the opinion that the earth moves and the sun is stationary, or even the contrary opinion, under pain of further punishment. The *Dialogues* were to be prohibited, and copies of the sentence were to be sent to all Papal envoys and Inquisitors, the same being read publicly in Florence.

Accordingly, on 21st June Galileo was summoned once more. In answer to questions put three times, Galileo replied on oath : " I do not hold and have not held this opinion of Copernicus since the command was given me that I must abandon it. For the rest, I am here in your hands ; do with me as you please." After this he was lodged in a commodious apartment in the Holy Office awaiting the official sentence. It is quite certain that he was not,

according to the cant phrase, "thrown into the dungeons of the Inquisition"; nor is there any truth in the idea that he was actually subjected to torture, since the Roman usage precluded its application after the age of sixty years. The following passage from Mr. Arthur Berry's *Short History of Astronomy* (University Extension Manuals, Murray, 1898) may be quoted as a non-Catholic endorsement of the foregoing:—"The three days June 21-24 are the only ones which Galilei *could*¹ have spent in an actual prison, and there seems no reason to suppose that they were spent elsewhere than in the comfortable rooms in which it is known that he lived during most of April" (p. 170, footnote).

¹ Italics of author.

VI. FROM 1633 TO 1642

FINALLY, on 22nd June, Galileo was conducted to the hall of the Dominican Convent of S. Maria sopra Minerva, where in full assembly his sentence was read to him as follows :—

THE SENTENCE

“ We, the undersigned,

GASPARO of Santa Croce in Gerusalemme, Borgia,
FRA FELICE CENTINO of S. Anastasia, called
Ascoli,

GUIDO of Santa Maria del Popolo, Bentivoglio,
FRA DESIDERIO SCAGLIA of S. Carlo, called
Cremona,

FRA ANTONIO BARBERINI, called S. Onofrio,
LAUDIVIO ZACCHIA of S. Pietro in Vincoli, called
San-Sisto,

BERLINGERO of San Agostino, Gessi,
FABRIZIO of S. Lorenzo in Pane e Perna, Verospi,
FRANCESCO of S. Lorenzo in Damaso, Barberini,
MARTINO of Santa Maria Nuova, Ginetti,

by the grace of God, Cardinals of the Holy

Roman Church, Inquisitors General throughout the whole Christian Republic, Special Deputies of the Holy Apostolical Chair against heretical depravity :

“ Whereas you, Galileo, son of the late Vincenzo Galilei, of Florence, aged 70 years, were denounced, in 1615, to this Holy Office, for holding as true a false doctrine taught by many, namely, that the sun is immovable in the centre of the world, and that the earth moves, and also with a diurnal motion ; also for having pupils whom you instructed in the same opinions ; also for maintaining a correspondence on the same with some German mathematicians ; also for publishing certain letters on the sun-spots, in which you developed the same doctrine as true ; also for answering the objections which were continually produced from the Holy Scriptures, by glozing the said Scriptures according to your own meaning ; and whereas thereupon was produced the copy of a writing, in form of a letter, professedly written by you to a person formerly your pupil, in which, following the hypothesis of Copernicus, you include several propositions contrary to the true sense and authority of the Holy Scriptures ; therefore (this Holy Tribunal being desirous of providing against the disorder and mischief which were thence proceeding and increasing to the detriment of the Holy Faith), by the desire of his Holiness and of the Most Eminent Lords, Cardinals of this supreme and universal Inquisition, the two propositions of the stability of the sun and the motion of the earth

were qualified by the Theological Qualifiers as follows :—

“ 1. The proposition that the sun is the centre of the world and immovable from its place is absurd, philosophically false, and formally heretical ; because it is expressly contrary to the Holy Scriptures.

“ 2. The proposition that the earth is not the centre of the world, nor immovable, but that it moves, and also with a diurnal motion, is also absurd, philosophically false, and, theologically considered, at least erroneous in faith.

“ But whereas, being pleased at that time to deal mildly with you, it was decreed in the Holy Congregation, held before his Holiness on the twenty-fifth day of February 1616, that his Eminence the Lord Cardinal Bellarmine should enjoin you to give up altogether the said false doctrine ; and, if you should refuse, that you should be ordered by the Commissary of the Holy Office to relinquish it, not to teach it to others, nor to defend it ; and in default of acquiescence, that you should be imprisoned ; and whereas in execution of this decree, on the following day, at the Palace, in presence of his Eminence the said Lord Cardinal Bellarmine, after you had been mildly admonished by the said Lord Cardinal, you were commanded by the Commissary of the Holy Office, before a notary and witnesses, to relinquish altogether the said false opinion, and, in future, neither to defend nor teach it in any manner, neither verbally nor in writing,

and upon your promising obedience you were dismissed.

“And, in order that so pernicious a doctrine might be altogether rooted out, nor insinuate itself further to the heavy detriment of the Catholic truth, a decree emanated from the Holy Congregation of the Index prohibiting the books which treat of this doctrine, declaring it false and altogether contrary to the Holy and Divine Scripture.

“And whereas a book has since appeared published at Florence last year, the title of which showed that you were the author, which title is *The Dialogue of Galileo Galilei, on the Two Principal Systems of the World—the Ptolemaic and Copernican*; and whereas the Holy Congregation has heard that, in consequence of printing the said book, the false opinion of the earth’s motion and stability of the sun is daily gaining ground, the said book has been taken into careful consideration, and in it has been detected a glaring violation of the said order, which had been intimated to you; inasmuch as in this book you have defended the said opinion, already, and in your presence, condemned; although, in the same book, you labour with many circumlocutions to induce the belief that it is left by you undecided and merely probable, which is equally a very grave error, since an opinion can in no way be probable which has been already declared and finally determined contrary to the Divine Scripture. Therefore, by Our order, you have been cited to this Holy

Office, where, on your examination upon oath, you have acknowledged the said book as written and printed by you. You also confessed that you began to write the said book ten or twelve years ago, after the order aforesaid had been given. Also that you had demanded licence to publish it, without signifying to those who granted you this permission that you had been commanded not to hold, defend, or teach the said doctrine in any manner. You also confessed that the style of the said book was, in many places, so composed that the reader might think the arguments adduced on the false side to be so worded as more effectually to compel conviction than to be easily refutable, alleging, in excuse, that you had thus run into an error, foreign (as you say) to your intention, from writing in the form of a dialogue, and in consequence of the natural complacency which every one feels with regard to his own subtleties, and in showing himself more skilful than the generality of mankind in contriving, even in favour of false propositions, ingenious and plausible arguments.

“And, upon a convenient time being given you for making your defence, you produced a certificate in the handwriting of his Eminence the Lord Cardinal Bellarmine, procured, as you said, by yourself, that you might defend yourself against the calumnies of your enemies, who reported that you had abjured your opinions, and had been punished by the Holy Office; in which certificate it is declared that you

had not abjured nor had been punished, but merely that the declaration made by his Holiness, and promulgated by the Holy Congregation of the Index, had been announced to you, which declares that the opinion of the motion of the earth and stability of the sun is contrary to the Holy Scriptures, and, therefore, cannot be held or defended. Wherefore, since no mention is there made of two articles of the order, to wit, the order 'not to teach' and 'in any manner,' you argued that We ought to believe that in the lapse of fourteen or sixteen years they had escaped your memory, and that this was also the reason why you were silent as to the order when you sought permission to publish your book, and that this is said by you, not to excuse your error, but that it may be attributed to vainglorious ambition rather than to malice. But this very certificate, produced on your behalf, has greatly aggravated your offence, since it is therein declared that the said opinion is contrary to the Holy Scriptures, and yet you have dared to treat of it, and to argue that it is probable. Nor is there any extenuation in the licence, artfully and cunningly extorted by you, since you did not intimate the command imposed upon you. But whereas it appeared to Us that you had not disclosed the whole truth with regard to your intention, We thought it necessary to proceed to the rigorous examination of you, in which (without any prejudice to what you had confessed, and which is above detailed against you, with regard

to your said intention) you answered like a good Catholic.

“Therefore, having seen and maturely considered the merits of your cause, with your said confessions and excuses, and everything else which ought to be seen and considered, We have come to the under-written final sentence against you :—

“Invoking, therefore, the Most Holy Name of our Lord Jesus Christ, and of His Most Glorious Virgin Mother, Mary, We pronounce this Our final sentence, which, sitting in council and judgement with the Reverend Masters of Sacred Theology and Doctors of both Laws, Our Assessors, We put forth in this writing in regard to the matters and controversies between the Magnificent Carlo Sincero, Doctor of both Laws, Fiscal Proctor of the Holy Office, of the one part : and you, Galileo Galilei, defendant, tried and confessed as above, of the other part : We pronounce, judge, and declare, that you, the said Galileo, by reason of these things which have been detailed in the course of this writing, and which, as above, you have confessed, have rendered yourself vehemently suspected by this Holy Office of heresy, that is, of having believed and held the doctrine (which is false and contrary to the Holy and Divine Scriptures) that the sun is the centre of the world and that it does not move from east to west, and that the earth does move, and is not the centre of the world ; also, that an opinion can be held and supported as probable after it has been declared

and finally decreed contrary to the Holy Scripture ; and, consequently, that you have incurred all the censures and penalties enjoined and promulgated in the sacred canons and other general and particular constitutions against delinquents of this description. From which it is Our pleasure that you be absolved, provided that with a sincere heart and unfeigned faith, in Our presence, you abjure, curse, and detest the said errors and heresies, and every other error and heresy contrary to the Catholic and Apostolic Church of Rome, in the form now shown you.

“ But that your grievous and pernicious error and transgression may not go altogether unpunished, and that you may be made more cautious in future, and may be a warning to others to abstain from delinquencies of this sort, We decree that the book *Dialogues of Galileo Galilei* be prohibited by a public edict,¹ and We condemn you to the formal prison of this Holy Office for a period determinable at Our pleasure ; and by way of salutary penance We order you during the next three years to recite, once a week, the seven penitential psalms, reserving to Ourselves the power of moderating, commuting, or taking off the whole or part of the said punishment or penance.

“ And so We say, pronounce, and by Our sentence declare, decree, and reserve, in this and in every other better form and manner, which lawfully We

¹ A decree of the Index to this effect was published on August 23rd, 1634.

may and can use. So We, the subscribing Cardinals, pronounce.

“FELIX, Cardinal di Ascoli.

“GUIDO, Cardinal Bentivoglio.

“DESIDERIO, Cardinal di Cremona.

“ANTONIO, Cardinal S. Onofrio.

“BERLINGERO, Cardinal Gessi.

“FABRIZIO, Cardinal Verospi.

“MARTINO, Cardinal Ginetti.”

THE ABJURATION

In conformity with the foregoing sentence, Galileo was made to kneel before the Inquisition, and make the following abjuration :—

“I, Galileo Galilei, son of the late Vincenzo Galilei of Florence, aged seventy years, being brought personally to judgement, and kneeling before you, Most Eminent and Most Reverend Lords, Cardinals, General Inquisitors of the Universal Christian Republic against heretical depravity, having before my eyes the Holy Gospels which I touch with my own hands, swear that I have always believed, and, with the help of God, will in future believe, every article which the Holy Catholic and Apostolic Church of Rome holds, teaches, and preaches. But because I have been enjoined, by this Holy Office, altogether to abandon the false opinion which maintains that the sun is the centre and immovable, and forbidden to hold, defend, or teach the said false doctrine in any manner; and

because, after it had been signified to me that the said doctrine is repugnant to the Holy Scripture, I have written and printed a book, in which I treat of the same condemned doctrine, and adduce reasons with great force in support of the same, without giving any solution, and therefore have been judged grievously suspected of heresy ; that is to say, that I held and believed that the sun is the centre of the world and immovable, and that the earth is not the centre and movable, I am willing to remove from the minds of your Eminences, and of every Catholic Christian, this vehement suspicion rightly entertained towards me, therefore, with a sincere heart and unfeigned faith, I abjure, curse, and detest the said errors and heresies, and generally every other error and sect contrary to the said Holy Church ; and I swear that I will nevermore in future say or assert anything, verbally or in writing, which may give rise to a similar suspicion of me ; but that if I shall know any heretic, or anyone suspected of heresy, I will denounce him to this Holy Office, or to the Inquisitor and Ordinary of the place in which I may be. I swear, moreover, and promise that I will fulfil and observe fully all the penances which have been or shall be laid on me by this Holy Office. But if it shall happen that I violate any of my said promises, oaths, and protestations (which God avert !), I subject myself to all the pains and punishments which have been decreed and promulgated by the sacred canons and other general and particular con-

stitutions against delinquents of this description. So, may God help me, and His Holy Gospels, which I touch with my own hands, I, the above-named Galileo Galilei, have abjured, sworn, promised, and bound myself as above; and, in witness thereof, with my own hand have subscribed this present writing of my abjuration, which I have recited word for word.

“At Rome, in the Convent of Minerva, 22nd June, 1633, I, Galileo Galilei, have abjured as above with my own hand.”

The fact that, whereas the names of ten cardinals appear in the preamble, only seven subscribed at the conclusion, has been interpreted as if showing non-acquiescence in the sentence on the part of three cardinals; but this is explainable on the ground of accidental absence. It is also to be noted that none of the decrees or orders in the Galileo case bear the Papal signature or official ratification. Controversialists in trying to vindicate the Church have sometimes laid undue stress on this fact, which, however, has no vital significance. Many acts of the Congregations are similarly devoid of such Papal confirmation, and are nevertheless valid. In the case of Galileo we know perfectly well that the Popes of the time were fully conversant with the proceedings, which could not have come into effect without their approval. Urban VIII. in particular may have desired to keep in the background for one or both of two reasons: (1) knowing that a real or

supposed personal affront to himself was involved in the case, he might not wish to give the impression of personal hostility by attaching his signature ; (2) motives of expediency may have led him to keep out of the business officially, and to leave it to be treated departmentally, lest the name of the Papacy itself should be too publicly associated with an act which was to a great extent mixed up with bitter party feelings, and might in the end prove to be a mistake.

We have seen that in point of personal handling Galileo was treated with unusual leniency, and in fact with special consideration. His imprisonment (so-called) was nothing more than a form of seclusion on parole. The mention of torture was merely in accordance with the usual formulas, at a time when torture was still part of the normal procedure of civil as well as ecclesiastical courts. It is certain that no torture was applied ; and probably it was not even contemplated. Finally we may mention, only to dismiss, the fable according to which Galileo, when rising from his knees after his abjuration, muttered in secret protest : “*Eppur si muove*”—“And yet the earth *does* move.” The earliest mention of this story only occurs in 1761, more than a century after the event. It is improbable that Galileo would have been so foolish as to run the risk which such an ejaculation, if overheard, would have involved.

LAST YEARS AND DEATH

After the abjuration was over, Galileo's sentence of imprisonment was commuted into seclusion at the villa of the Grand Duke of Tuscany near Rome, which was to be regarded as his prison. His condemnation was sent to all Papal nuncios and inquisitors, and read publicly to the professors and students at Padua and Florence. Copies of the forbidden book were searched for and destroyed, while those who had been instrumental in giving the *Imprimatur* suffered for it in various ways. In reply to Galileo's request to be allowed to return to Florence the Pope answered: "We must proceed gently and only rehabilitate him by degrees."

He was soon allowed to retire to Siena, where he became an honoured guest of the Archbishop. Here he began a new work called *Dialogues on the New Sciences*. Later on in the year he was permitted to return to his villa at Arcetri near Florence, but was not allowed to go to the city. The *Dialogues on the New Sciences*, which dealt with concussion, resistance to fracture, and uniform, accelerated, and projectile motion, were completed in 1636. Then came the question of publication. On the principle, perhaps, that "the burnt child fears the fire"—or as the proverb has it, "once bit, twice shy"—he had not the courage to offer his book for ecclesiastical censorship; hence he tried the subterfuge of publication outside the range of the Inquisi-

tion, and the work appeared at Amsterdam in 1638 on the pretence that it was pirated from a private MS. copy. It is even stated that he evaded the prohibition of his *Dialogue on the Two Systems* by encouraging its publication in Latin at Strasburg. The first edition appeared in 1635 ; while another edition, with corrections dictated by Galileo himself, followed in 1641.

His sight, which had been failing for some years, now grew so bad that he lost the use of one eye. This led his friends to renew their entreaties with the Pope. "They endeavoured" (wrote Galileo to one of them in 1636) "to convince His Holiness that I never had such an iniquitous thought as to make game of him, as my wretched enemies had persuaded him—which was the prime mover of all my troubles. At length the Holy Father pronounced my exculpation, saying, 'We believe it, We believe it now'—adding, however, all the same, that the reading of the *Dialogues* was most pernicious to Christianity." In the end leave was given him to return to Florence to live in "his son's little house," but under orders not to discuss the forbidden doctrines or to go about publicly in the city ; though he was allowed to drive out of the city to his villa at Arcetri. In 1639 Galileo finally returned to his villa and remained there, where he became quite blind, and dragged on a suffering existence till, on 8th January 1642, he died at the age of seventy-eight, fortified by the last rites of the Church and the benediction of Urban VIII., and was buried in the church of Santa Croce.

VII. REVIEW OF THE CASE

HAVING given the whole of the case more or less without comment, we now proceed to weigh its import from various points of view.

THE MODERN SCIENTIFIC VIEW

At the present day no one in civilized life could, without being suspected of lunacy, maintain the geocentric system of astronomy which Galileo opposed, or entertain any serious doubt about the heliocentric system which Galileo maintained. Taking up any school text-book of to-day, you will find this latter system outlined briefly as follows :—The sun is the centre of our immediate astronomical environment. Round it revolve, in elliptical orbits, finely distinguishable on paper from a perfect circle, a number of planets, of which Mercury and Venus are nearest the sun ; the earth comes next ; outside this Mars, Saturn, and Jupiter, which are visible, and Uranus and Neptune, which are invisible to the naked eye. Round several of these planets there revolve smaller satellites called moons ; the earth having one, Mars

two, Jupiter eight, while Saturn with nine is also surrounded by disc-like rings, etc. The whole group is called the solar system, whose movements are determined by two opposing forces, formerly called centrifugal and centripetal; now better described as the tendency of a spun-off body to fly away from its centre in a tangential straight line, opposed by the force of gravitation drawing it back to the centre from which it has been spun—the elliptical orbits of the planets being produced by the oscillating balance of these two opposing forces. Outside this solar group are the stars, so inconceivably distant as to seem motionless and solitary; but probably each one is a solar group similar to our own. Relatively to the solar system itself the sun is a fixed immovable centre, but relatively to space in general the sun and its planets as a group are in motion, probably revolving round some distant centre, in conjunction with the whole collection of the stars.

The theory thus briefly outlined displays, of course, an immense advancement on Galileo's knowledge, but in essence it is the Copernican system for which Galileo fought and for which he was condemned. As for proof of its truth, we cannot say that it amounts to a demonstration of strict formal logic; but it is a theory which, first adopted as a hypothesis, has been found to work and to explain everything, and even to afford a reliable basis for anticipating future or unknown facts. And this verification has been carried on so long and so

minutely as to destroy all psychological disposition to doubt its truth.

THE MODERN THEOLOGICAL VIEW

The universal attitude of theologians with regard to this system is that it offers no difficulty in relation to revealed truth. It is true that the Scripture in many places uses language which corresponds to the older theory, and to the common estimate of the senses. The earth is spoken of as if it were the fixed centre of the world, while the sun and all the heavenly bodies are described as moving round or above the earth, etc. But it is a well-established principle that inspired writers could make use of such language according to the obvious appearance of things and the common estimate, without thereby committing themselves to any scientific position on the matter. Hence no attempt is made to appeal to Scripture as affording an argument against the conclusions of modern science; but the conclusions of modern science are accepted as facts, and the Scripture is interpreted in the light of the facts.

COMPARISON WITH GALILEO'S TIME

We are nowadays so secure on both these points that it never enters into our mind to feel any doubt or scruple on either of them. Hence it fills us with the deepest astonishment to think that the scientists or theologians of those days could have taken up the

attitude they did. Our sympathies are all with Galileo who was so unquestionably right, and against his enemies who were undoubtedly wrong—so much so, that we can hardly help looking upon them as the blindest of fanatics or the most malicious of demons engaged in a conspiracy against justice and truth.

In order to remove this dismal impression it is necessary to put on what we may call our “retrospective binoculars”—or, in other words, to tear ourselves out of our present environment and transfer ourselves back to those days, so as to enter into the minds of those who took part in the Galilean tragedy ;—in short, to put ourselves in their place and to permeate ourselves with their ideas, and to begin to think as they thought. As soon as we have done this we shall come to the conclusion that had we lived when they lived, we probably should have acted just as they did.

This psychological metamorphosis is singularly difficult, just because there does not exist in modern times any analogical example to which we can appeal for an illustration. Imagine some genius or other suddenly conceiving a new system of astronomy, as subversive of the Copernican as the Copernican was of the Ptolemaic. On reading an account of his theory in the papers we should all stand aghast at his boldness and perverted ingenuity, and merely laugh at him as a maniac. If such a man offered to prove his thesis, we doubt whether any scientific man

of our own day would think it compatible with his self-respect to listen to him or to give him a chance—so convinced are we of the truth of our present system. But suppose the new discoverer really did force his way, and invited the world to look through an instrument which he had invented, and which revealed to us the sun, moon, and planets moving in a way totally different from the orthodox view—for instance, that every motion of the heavenly bodies was in a straight line, which only appeared to us a curve relatively to our own shifting position in space. Modern scientific enterprise would not be long in showing itself; and the more formidable the evidence offered, the more keen would our specialists be in their investigations, either to confirm or refute the new alleged phenomena by independent observations. Not many years would have passed before the whole case would be sifted, and our present system either confirmed and strengthened or else exploded and abandoned. We are quite accustomed in these days to the upsetting of long-cherished ideas, and are so prone to empiric verification that any new theory which has a leg to stand on will be allowed to stand on that leg as long as it can, and will even be furnished with another leg as soon as one can be found for it.

We in modern times are prepared and equipped for revolutionary theories in science in exactly the way in which the scientists of the seventeenth century were neither prepared nor equipped. The

modern scientific mind is dominated by five ideas :—
(1) the re-verification of old facts ; (2) the free quest for new facts ; (3) the formation of a new hypothesis on new observed facts ; (4) the verification of the new hypothesis by further new facts ; (5) a disposition to regard all present knowledge as provisional, and to welcome the revision of it in favour of better knowledge.

The scientific mind of the Middle Ages was, on the contrary, dominated by five other ideas :—(1) the traditional acceptance of old facts which were taken for granted ; (2) a disposition to build up logical theories on these old facts, and to create a body of traditional doctrine to be handed down and improved upon intensively by closer analysis, but not to be questioned at its roots ; (3) reverence for philosophical authority as the starting-point of science, especially of Aristotle, the philosopher *par excellence* ; (4) a spirit of contentment with present knowledge, and a complacency in its *a priori* completeness ; (5) lastly, they were handicapped by a traditional interpretation of Scripture, which was taken as an authority not only in theology but also in science—so much so, that any scientific notion confirmed by the letter of the Bible received thereby the confirmation of God Himself, the source of all truth ; while any notion contrary to the letter of the Bible was *ipso facto* regarded with suspicion or even as out-and-out heresy.

GALILEO'S AGGRESSIVENESS

Turning now to Galileo and his earlier discoveries, we find three planes from which they might be viewed: (1) intrinsically as so many observed facts, with the inferences which follow from those facts; (2) extrinsically as conflicting with the traditional authority of Aristotle; (3) extrinsically as conflicting with the traditional authority of Scripture.

Suppose Galileo had kept quiet about philosophical questions, and had merely offered his discoveries of fact and waited till these had been widely accepted and adopted among the scientists around him. This would have gradually prepared the way to the undermining of Aristotle's teaching, and Galileo might have escaped the odium of shocking the prevailing reverence for authority, and have scored a victory instead of suffering a defeat. His aggressiveness may appear excusable and natural, but it was bad psychology. He began by "getting people's backs up," and therefore enlisted against himself all the prejudice and fanaticism which happened to exist in his environment. It requires heroic virtue for a professor, when suddenly told that his public teaching is all wrong, to accept the correction with humility, and to come down from his pedestal to sit at the feet of a youngster; and there were few of the pundits of the time capable of rising to this. The feeling of "being put in the wrong" is more than most people can stand.

We recognize how far from the spirit of true science were those professors ; but this weakness is rooted in human nature, especially in pedagogic human nature, and is common to all time. Hence the set against Galileo in his earlier career is painfully inexcusable ; but it is also painfully intelligible. Galileo suffered the usual fate of men who push in advance of their time. For the status of any period is measured by a certain aggregate ; and, putting aside a number of minds as advanced as Galileo himself, the ordinary professor of the sixteenth and seventeenth centuries was a creature hide-bound with traditional prejudices, touchy about his own prerogatives, and ill brooking correction. Against this stone wall of pedagogical pretension and prejudice Galileo playfully ran his head ; and little wonder if his head was broken by the impact.

Had Galileo been able to put forth his observations and their concomitant theories on a purely scientific basis, this Aristotelian pig-headedness of the pedagogue would probably in the long-run have done him no harm. There were quite enough men of independent mind in the world of that time to take interest in his discoveries, and to accept the conclusions to which they might lead. Except for collegiate boycottings, which he could easily have outlived, there was no tribunal of science or philosophy possessing the power to do him any hurt. The real mischief, of course, came from the traditional theology. It matters little that Galileo

himself never dreamed of entering into theological discussions till they were forced upon him. So long as the traditional view of the Scripture was in existence the conflict was inevitable. It is true that, as we have seen, there were many minds which could accept the Copernican theory without feeling any difficulty on the score of Scripture; and the Church was not irrevocably committed to the prevailing method of interpretation. But the prevailing interpretation was there, and was upheld by the rank-and-file of theologians, to whom the revolutionary ideas of Galileo came as a severe and sudden shock. If only the conflict could have been averted until men's minds had become familiar with the new discoveries, and convinced of their truth and of the inferences which flowed from them, all would have been well. The theological mind would have undergone a gentle readjustment. There would have been no shaking down of old-time prejudices, no panic, no alarmist cry that faith and Scripture were in danger: and Galileo himself would have figured as a benefactor both to science and theology, instead of appearing as a reckless overthrower of both. In point of fact, Galileo's consistent policy was to thrust his views as offensively as possible upon those who disliked them, and even to force the Church authorities to an official decision in his favour, on a point which otherwise they might gladly have left alone.

These remarks apply chiefly to Galileo's earlier

relations with the Universities, which first started the tide of hostility against him. The later ecclesiastical opposition at Rome belongs to a somewhat different category, and must receive separate treatment.

VIII. THE OPPOSITION NOT DISTINCTIVELY CATHOLIC

PERHAPS the most vitiating fallacy prevalent among Protestant controversialists is to take for granted that the defects, both of the scientific and of the theological mind, in Galileo's time, arose from the fact that both scientists and theologians were Catholics—or in other words, that the distinctive creed of the Roman Church lay at the back of the whole mischief. It requires only a very slight insight into the history of the time to show that this is not the case. In other matters, such as the constitution and authority of the Church, the doctrines of the sacraments, of indulgences, of justification, of the cultus of saints, and the use of images and relics, etc., there was a polaric difference between the Catholic and the Protestant standpoint. But in questions regarding the authority and inspiration and the meaning of Scripture no such difference existed—I mean, none such as to affect the question before us. Similarly in science, the same traditional doctrines prevailed in both camps.

PROTESTANT MEN OF SCIENCE

It would not be difficult, with a little casting about among books, to prove this twofold point to demonstration. But for our present purpose let a single example suffice in each case. Lord Bacon was born in 1561 and died in 1626, and therefore stands practically contemporary with Galileo and Kepler. Lord Bacon has been habitually called "the Father of Modern Science," and it is one of the glories of Protestantism to claim him as its own. Lord Bacon's fame in this regard rests upon his two works: *The Great Instauration* and the *Novum Organon*. It is to his credit that he was instrumental in bringing forward the necessity of a more inductive study of nature as a check on the *a priori*ism of the mediæval schools. But his merit both as a philosopher and a scientist has been highly overrated; and the comparative exiguity of his claims has been repeatedly recognized by independent writers, both Catholics and non-Catholics. De Maistre states that "Bacon in his philosophy deceives himself equally in that which he aims at, and the means he takes to attain it. He discovered little of what he pretends to have discovered. His *Novum Organon* is replete with the prejudices which possessed him. He makes flaring blunders in astronomy, in logic, in physics, in natural history, and fills his pages with childish observations, trifling experiments, and ridiculous explanations." Lest this

view be discounted by the fact that it proceeds from a Catholic writer, let us listen to Ueberweg, a non-Catholic, who says: "Bacon's development of the principles of his method was in many respects a failure; and his attempt to apply those principles by personal investigation is not to be compared with the achievements of earlier and contemporaneous investigators of nature." Professor Draper, also not a Catholic, writes:—"Bacon never received the Copernican system. With the audacity of ignorance he presumed to criticize what he did not understand, and with a superb conceit disparaged the great Copernicus. The more we examine the writings of Lord Bacon the more unworthy does he seem to have been of the great reputation which has been assigned to him. The popular delusion, to which he owes so much, originated at a time when the history of science was unknown. This boasted founder of a new philosophy could not comprehend and would not accept the greatest of all scientific discoveries when it was plainly set before his eyes."

The instances of false assumption which the conservative scientists of Italy opposed to Galileo's discoveries seem to us truly ridiculous in many cases; but they are not in any way more so than those which we find scattered over the works of Lord Bacon. Among his aphorisms occur the following:—"Wooden arrows without an iron point penetrate farther into wooden substance than the

same arrows pointed with iron, owing to the similarity of substance"; "It is certain that in projectiles the impact is not so violent at too short a distance as a little afterwards"; "There is a singular motion of attraction between quicksilver and gold; and those who work surrounded by the vapours of quicksilver are wont to hold a piece of gold in their mouths to collect the exhalations, which would otherwise attack the head and bones; and this piece of gold soon grows white"; "There is no expansive motion to be allowed for ignited iron, for it does not swell its bulk under the influence of heat, but retains the same apparent dimensions." He also describes an experiment by which he succeeded in reducing water to seven-eighths of its original volume by pressure! "Every tangible body with which we are acquainted contains an invisible and intangible spirit, over which it is drawn, and which it seems to clothe. The departure or emission of this spirit is rendered sensible in the rust of metals," etc., etc. Bacon's collection of experimental problems called the *Silva Silvarum* is full of similar scientific fictions which Bacon implicitly takes for granted, any of which could have easily been refuted by a single carefully conducted experiment. But what is most to our point is the fact that Bacon categorically rejected the whole Copernican system, and spoke of Copernicus as "a man who thinks nothing of introducing fictions of any kind into nature, provided his calculations turn out well." Whewell complains that

Bacon did not even understand the older system of Ptolemy which Copernicus had supplanted.

I am not putting this fact forward with the invidious object of belittling Bacon or of demolishing one of the Protestant idols. I am merely trying to give fair play to Bacon's Italian contemporaries, by showing that their blind reverence for a traditional inheritance of supposed learning was not anything distinctively Catholic. In wider confirmation of the same equalizing argument, I may add that as Bacon, "the Father of Modern Science," sided with the intransigency of the mediævals against Copernicanism, so also did Descartes, "the Father of Modern Philosophy" (falsely so-called), whose theory of vortices did so much to keep back the development of modern science. Nor was this "opposition to the greatest of all scientific discoveries" confined to these two branches. For, as we read in Hallam: "In the middle of the seventeenth century and long afterwards there were still mathematicians of no small reputation who struggled staunchly for the immovability of the earth."

PROTESTANT THEOLOGIANS

Let this suffice towards providing a proper historical perspective in the department of science. Turning to theology, it has next to be shown that the condemnation of Copernicanism was not peculiar to Catholic divines, but was shared just as actively by Protestant divines. It is a well-known fact that

at the very time when the Popes were patronizing the writings of Copernicus, Luther was calling him "a fool" because he had turned astronomy upside down ; and Melanchthon and practically all Protestant preachers and professors were strongly condemning the system as contrary to the teaching of the Bible.

A most striking instance comes before us in the case of Kepler, who (born 1571, died 1630) was a contemporary of Galileo, and occupied a place in science in Germany similar to that of Galileo in Italy. The two biographies are strikingly similar. Galileo was of a well-reputed civic family ; so was Kepler. Galileo was handicapped by "an ill-starred union" ; so was Kepler. Galileo was engaged in a constant struggle with ill-health ; so was Kepler. Galileo suffered from family misfortune and constant poverty ; so did Kepler. Galileo nibbled at a clerical vocation ; so did Kepler. Both worked themselves up to a university career. Both were captivated by the theory of Copernicus. Both dabbled with astrological almanacs. Both made many discoveries, some true, some fallacious. Both gained a world-wide reputation thereby. Both were honoured with the post of mathematicians to reigning houses, and both suffered from insufficient pay for their eminent services. Both were involved in vexatious disputes with obstinately conservative opponents. In both cases the opposing party prevailed. Finally, both Galileo and Kepler were hauled before a theological tribunal and condemned for heresy.

I allude here to the condemnation of Kepler by the Theological Faculty of Tübingen (Protestant) in 1596, for affirming the identical scientific truth for which thirty-seven years later Galileo got into trouble. When he wrote his celebrated work *Prodromus Dissertationum Cosmographicarum* to demonstrate the truth of the Copernican system, he had to lay it before the Academical Senate of Tübingen for their approbation, without which it could not be printed. The unanimous decision of the divines in this senate was that Kepler's book contained a deadly heresy, because it contradicted the teaching of the Bible in that passage where Joshua commands the sun to stand still, a verdict precisely similar to that of the Roman Congregations. To this Kepler replied that, as the Bible addressed itself to mankind in general, it spoke of things in the life of men as men in general are accustomed to speak of them; that the Bible was in no respect a manual of optics or astronomy, but had far higher objects in view; that it was a blameable abuse to seek in it for answers to worldly things; that Joshua had wished to have the day prolonged and God had responded to his wish; how this happened was not a subject for inquiry—precisely the answer given by Galileo. In spite of this argument his judges repeated their condemnation; and the vexations which followed caused him to write in despair to his friend Mästlin that he held it best to imitate the disciples of Pythagoras and keep silence on the

discoveries he had made, lest like Apian he should lose his situation and be doomed to die of hunger.

The upshot was that he took refuge with the Jesuits of Gratz and Ingoldstat—of all people in the world,—who received the great Protestant discoverer with open arms because of the services he had rendered to science. Kepler ended in being appointed Court Astronomer to the Emperor Rudolph at Prague.¹

¹ Kepler was not subjected to torture ; neither was Galileo. But, as illustrating the usage of the times even in Protestant countries, we read incidentally that Kepler's mother, being suspected of sorcery, was imprisoned for thirteen months and underwent examination under "imminent threat of torture," which, however, was not carried out.

IX. THE CATHOLIC ATTITUDE

HAVING thus established a parallelism between the Protestant and Catholic situations, and disposed of the idea that the scientific or theological attitude in Italy was peculiar to or in any way bound up with Catholicism, we have next to pass from the similarities to the differences. This carries us down to the roots of the Reformation programme, which consisted essentially in the rejection of the Church as an authoritative teaching and governing body, and the setting-up of the Scripture interpreted by private judgement as the sole rule of faith in its place. Whatever the outsider may think of the merits of the two positions, this gives a certain logical consistency to the severity of the Roman Congregations, and an equally illogical inconsistency to that of the Protestant divines. They might indeed register their own personal view that the Copernican system was contrary to Scripture; but they could not consistently object to Kepler holding that it was not contrary to Scripture, or interfere with the liberty of his teaching on that score. Let it be clear that we are not now concerned with the question which

of these two theological principles is right and which wrong. The Catholic view is that the Church had a perfect theoretical right to pass judgement on Galileo, even though the judgement passed turned out wrong: for in doing this the Church was exercising its rightful jurisdiction in faith, morals, and discipline, and the error of its verdict was one of faulty human application, and not one of root-principle. On the other hand, the Protestant divines of Tübingen were wrong on both counts: first, in the falsity of their concrete sentence, and secondly, in denying to others the same exercise of private judgement which it was their greatest glory to claim for themselves. What we are concerned with here is merely to make it intelligible how the Roman Congregations could act as they did consistently with a sound principle, and yet could err in the application of that principle; and how this misapplication still leaves the underlying principle intact.

DOGMATIC ACTS

We hold that the Church is at once divine in its institution and human in its working, that its teaching and ruling officials are not endowed with any inherent gift of inerrancy either in the way of omniscient perspicuity of mind or of personal revelation or inspiration. This would imply that the Church authorities have to work according to their natural lights, and may be sometimes right and sometimes wrong according to the bent of their mind

and the influence of their circumstances. But this concession is conditioned by the proviso of a controlling Providence which, while leaving the general working of the Church to proceed according to the vicissitudes of human nature, still preserves the right course in essentials so as to leave the Church a reliable teacher and ruler of mankind. The result of this divine supervision is that, whenever we find any point of faith and morals unquestionably held and taught and believed in the Church as part of the divine deposit of truth, we can be absolutely certain that such a point is correct.

The Church has, moreover, in case of dispute, a power of coming to a final determination in faith and morals and of making this determination binding in conscience. This power can, however, be exercised only in one of two ways : either by the definition of a General Council under the headship of the Pope, or else by a similar definition issued by the head alone, which of itself has the same binding force as if it had proceeded from the deliberations of a General Council. This sort of definition is called *ex cathedra* ; meaning that it is solemnly promulgated by the Pope acting as head of the Church, and intended to bind the whole Church to acceptance in such a way as to become a condition of membership, and, moreover, to be irrevocable and irreformable. When the Pope does commit himself and the Church to a definition in this way, we are infallibly certain that he is right ; on the ground that the promises of

Christ will never allow Him to commit the universal Church irrevocably to error. This, in a nutshell, is what we mean, and *all* that we mean, by Papal infallibility.

DISCIPLINARY ACTS

But the exercise of this prerogative as a final resort is comparatively rare, and never entered into the Galileo case at all. Normally, the work of the Church in current contingencies is done in a way which is declarative and disciplinary. The Pope by his encyclicals, and the Roman Congregations by their decrees, issue decisions on current questions which do not pretend of their own force to be absolute and irrevocable. In many cases they presuppose and embody doctrines which are unquestionably true, and already known and believed, but which have only to be redeclared, emphasized, and enforced. In other cases they follow the prevailing view of theologians, and uphold it as at least something practically safe, without precluding the possibility that in course of time the prevailing theological view may undergo a change. Such decisions therefore are not irrevocable; they may even be objectively incorrect. But, even so, they impose the duty of submission for the time being as part of the discipline of the Church. Cases could occur—and the Galileo incident is perhaps the most pronounced instance in history—in which the specialist in science or scholarship is nearer the truth

than the authorities who pass sentence on his teaching. In this case the inalienable right of the mind to adhere to its perceptions of the truth is not outraged. The mind of the specialist may remain convinced of the truth, and his views may be ascertained to be objectively right; and yet he is called upon to exercise the virtue of submission, and to accept the verdict of his judges—to this extent at least, that he abstains from outwardly opposing them by a propagation of his views. In other words, he must recognize and yield to authority as a guide of his conduct, even though ~~convinced~~ that the application of that authority is in this instance misplaced. This demand, though greatly counter to the modern spirit, is by no means peculiar to the Church. In the army and navy and government service a similar implicitness of obedience is demanded, even where the subordinate is fully convinced that his superiors are wrong; and any display of resistance to or discontent with the orders given is looked upon as insubordination, and is punished accordingly. The only difference is that in these departments nothing is demanded but an exterior conformity, leaving the man to swear up his sleeve as much as he likes. The Catholic Church demands something more than this, namely, a spirit of interior loyalty to authority on the grounds of obedience, even though the interior conviction remains unchanged—just as a child who fails to see the justice of its father's

commands, still throws himself into their execution with good will, out of a spirit of filial devotion and respect.

The subject is one which it may be desirable to discuss somewhat more in detail.

THE SPIRIT OF OBEDIENCE

It may be said in a blunt, homely way that Rome is particularly "down" upon a man who shows contempt or disregard for Church discipline, or whose teaching or attitude is calculated in any way to minimize the respect and reverence in which Church authority is held. This severe attitude does not spring from any overweening pretension to power, or any exaggerated idea of their own prerogatives. Their position in this matter is quite according to the standard theology, which restricts infallibility to *ex cathedra* utterances by the Pope himself, and allows that all other officials in the whole range of their official work are fallible men capable of mistakes. But even as fallible men are capable of mistakes, it is a matter of principle that their enactments shall have binding force, and shall command respectful submission—not on the ground of the intrinsic soundness and irrefragable accuracy of their decisions, but for sake of the virtue of obedience itself.

The idea of obedience has become so weakened in the modern mind that it is necessary to explain

the matter in order to make this position intelligible. According to our ascetical theology, obedience is not merely a submission perforce to one who has the *power* to impose his will on us ; nor is it merely conformity of action based on the fact that the orders given recommend themselves to the judgement as sound and desirable to follow. No, obedience is a submission of the whole man to the will of one placed in legitimate authority to rule and govern us—so that we do not look to the person who commands, nor to his prudence or other qualities, as the ground of our subservience ; but rather to his position of authority as derived from God, in virtue of which his will becomes to us an expression of God's will, and a determinant of our action, quite apart from the question whether the command itself is commendable on its own merits. Our conception of obedience in Church matters is in fact precisely on the lines of that obedience which children owe their parents, which consist in looking upon them personally with reverence, and upon all orders given by them as something to be loyally and devotedly received and followed, without entering into any debate as to the merits of the order or its intrinsic prudence or advisability. This obedience has all the implicitness of that due by a soldier to his officer, as regards actual execution ; but it demands quite a higher spirit of loyalty and reverence, not only exterior but interior, which is not contemplated in the military virtue. The spirit of obedience is

certainly not servile in a child ; and He who said, "Unless you become as little children you shall not enter into the kingdom of heaven," included not merely the innocence of the child, but also its humility and implicit subjection to authority, as part of the qualification required. However, without arguing out the Gospel foundation of the idea, it is enough to state the fact, otherwise unintelligible to the mind of the outsider, that this spirit of obedience to Church authority is one of the essential features of the Catholic life, and one of the safeguards of the *obsequium fidei* itself. It is a virtue which must be cherished even when the application of authority is incidentally misplaced—the matter of the orders given being of comparative little moment when compared with the virtue of obedience which is exercised by submission to such orders.

Hence, while candidly viewing it as lamentable, in the light of subsequent knowledge, that the Roman Congregations should in 1616 have imposed upon Galileo any injunction not to teach or defend the Copernican system of astronomy, especially on the erroneous ground that it was heretical and counter to the teaching of the Bible ; and secondly, while feeling the utmost sympathy with Galileo on account of the vexatious restriction thus placed upon him, and the very severe test to which his virtue was thereby put ; still, in the light of the principle of obedience to authority as just explained—which



certainly permeated the whole Catholic mind of those times—we can at least view the situation as intelligible, and can take quite a different view of the severities of 1633 from that which the surface aspect would suggest.

This, we are aware, is something quite alien to the standpoint of the “modern” man, who is devoid of all notion of submission to Church authority and recognizes no other standard of thought and action than that of untrammelled individual liberty, and with whom the whole idea of the sanctifying power of obedience has been totally lost. Such people have so lost the spirit of faith as to fail to understand it. They look upon religious membership of a Church as a mere outcome of agreement of opinion; they scorn anything like the *obsequium fidei* as a mere implicit assent to certain formal propositions of a creed; whereas according to the Catholic idea Church membership is something more: a moral discipline as well as a mental one; a submission not only to the immutable dogmas of divine revelation, but also to the mutable and contingent pressure of Church government. This relation, we believe, disciplines at once the intellect and the will, and makes a man master of himself precisely by submitting to the mastery of others whenever that mastery is exercised by the legitimately constituted authorities of the Church.

We are not here concerned with preaching this principle, still less with asking outsiders to accept or

endorse it. All we say is that if they wish to view the Galileo case in an intelligible light, they must be at least aware of the existence of this principle among Catholics, and must understand what it is and how it works.

X. THE SAFER COURSE

BUT besides the doctrinal and the disciplinary, we have still to deal with a third aspect of the Church's practical policy.

Confronted with current questions which in any way affect the minds of the faithful, the Church feels bound sometimes to press her influence beyond the intrinsic merits of the question, whether of doctrine or of discipline, and to adopt what is known as "the safer course." The Church in itself is essentially conservative in tendency, and is therefore much keener in preserving what is old than in promoting what is new. The reason is twofold. In the first place, the Church's official scope is not the development of human knowledge but the preservation of divine knowledge. She is the recipient of an original deposit of revelation, which it is her business to preserve and hand down intact to succeeding generations. Strictly speaking she has no concern in human science as such. If a given opinion put forward in science steers clear of this deposit, she is content to leave it alone. But if such an opinion clashes with her deposit, she draws at once the

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a priori conclusion that such an opinion is wrong, and will pronounce her condemnation of it and forbid its acceptance accordingly. This kind of proceeding is perfectly easy if the conflict between new opinion and old revelation is ascertained beyond all possibility of doubt. But a double obscurity is often possible. On the one hand, the new opinion may be objectively true, but is not so far demonstrated, and therefore can reasonably be disbelieved. On the other hand, a prevailing view among theologians, though taken for granted as a traditional inheritance, may not after all be a matter of divine revelation, and so is capable of being abandoned.

The proper policy in such a case would be to suspend judgement till the matter had been thoroughly thrashed out—allowing the new view to undergo the test of time, and to demonstrate itself if possible, and allowing the theological view to adjust itself gradually to the advance of the facts. But such a policy of suspension, though the wise and prudent course in itself, might have certain disadvantages. Besides the question of objective truth in matters on science, the Church has to take into account the effects which the propagation of a novel theory might have on the faithful in general, whose simple mind is easily liable to be upset by too sudden a change of view. Hence the need of discouraging the new view, at least for the time, in order to avert these objectionable results.

SOME ILLUSTRATIONS

This idea will be best explained by some concrete examples :—

Down to a generation or two ago it was the general belief of Christians that the deluge of Noah covered the whole earth, and that it is so described in the most explicit terms in the Bible. Certain new considerations, mainly drawn from geology, led specialists to the contrary conclusion that the deluge was by no means universal, but was a comparatively local phenomenon ; widespread enough to cover the area occupied by mankind at that time, but not much more. This view at first found considerable opposition in theological circles ; partly because the restriction of the area of the flood was not as yet demonstrated beyond question, and partly because it ran counter to the literal text of the Scripture as universally understood by its interpreters. Fortunately, the view did not attain such sudden publicity as to cause a widespread sensation, and so no crisis arose. The partial-deluge view ✓ gradually came to look more and more feasible, and the possibility of interpreting Scripture accordingly became more and more evident. The new view gradually filtered down from learned circles to the man in the street, so that nowadays the partiality of the deluge is a matter of commonplace knowledge among all educated Christians, and is even taught to the rising generation in elementary schools.

But suppose this denial of the universality of the deluge had been suddenly sprung upon the world in general, and bruited about in the streets and squares of every city. It would come as a shock, not only to theologians of the conservative school, but also and above all to the faithful laity, who would look upon it as a sudden tactic of unbelief, and the upsetting of their simple faith in the word of God. Suppose, moreover, that those who embraced and propagated the new view were most of them men prone to be enamoured of "progress" and impatient of authority, while its opponents were men of unquestionable orthodoxy and edifying Catholic spirit. Before long a crisis would certainly arise. The cry would go forth that infidelity was spreading and the faith in danger. In such an emergency the Church authorities would feel the necessity of a remedy; and this remedy might easily take the form of condemning the new doctrine—not precisely because it was ascertained to be false or contrary to divine truth, but because its psychological effects on the minds of the faithful were practically destructive of their faith. In other words, the doctrine would have to be discountenanced for the time, not as false but as rash or unsafe, and its propagation as premature.

Other instances might easily be multiplied. For instance, the discovery two generations ago by geologists of the extreme antiquity of man on the earth was popularly regarded as an entire refutation of the Bible record, simply because people believed

that the date of Adam was fixed by the Bible ; and I remember a young man who actually became an infidel through reading a book of this kind.

Similarly in Italy, in the time of Galileo, it is quite likely that a number of people, accustomed to understand the miracle of Joshua in its literal terms, felt that the truth of the Bible was gone when it became clear that Joshua could not have caused the sun to stand still, because it was standing still already. In such a contingency a strong and assertive policy is required. The common people cannot in such matters understand compromise or critical caution : nothing but a vehement reassurance will suffice to allay their doubts. And thus on grounds of expediency the exaggerations of a categorical condemnation would meet with favour even among those who were not themselves disposed to be dogmatic on the point.

THESE THREE POINTS APPLIED

A careful examination of the whole of the Galileo case will show that all these three motives were at work, and that the official action taken was the result of their combination. Briefly enumerated, the three are :—

(1) The exigencies of *doctrine*, or of safeguarding the deposit of faith.

(2) The exigencies of *discipline*, or of safeguarding obedience to authority.

(3) The exigencies of *the faithful*, suggesting the adoption of the safer course.

(1) With regard to the defence of the faith, it seems clear that among the more enlightened minds Galileo's discoveries and the theory which accompanied them seem to have been decidedly acceptable, at least in a tentative way, and no difficulty was felt in reconciling them with Scripture. But so long as the new theory was undemonstrated, the policy was to uphold the traditional belief as being in possession. Among other indications of this we have the view of Bellarmine, who admitted that "so long as the Copernican doctrine is stated hypothetically there is no objection whatever to it; but to state it positively is opposed to the principle laid down by the Council of Trent, that Scripture should not be interpreted contrary to the common consent of the fathers and the universal opinion of modern commentators." Thereupon he immediately adds: "When there shall be a real demonstration that the sun stands in the centre of the universe and that the earth revolves round it, it will be necessary to proceed with great caution in explaining those passages of Scripture which seem contrary to it; and rather to say that we do not understand them, than to say that a thing which is demonstrated is false" (Wegg-Prosser, p. 38). The same view was expressed by the Jesuit theologian Fabri some years later: "There is no reason why the Church should not understand those texts in their literal sense so long as there is no demonstration to

prove the contrary. But if any such demonstration is devised by your party, the Church will not hesitate to set forth that those texts are to be understood in a non-literal and figurative sense" (*ib.*, p. 40).

This is a complete contemporary statement of the moderate policy mentioned above, namely, a suspension of judgement till the demonstration becomes clear—the traditional view remaining in possession till disproved. But besides this more moderate attitude there existed a strong and active body of theologians who were tenaciously opposed to the new view and in favour of the old one. Such were the Qualifiers of the process of 1616, who categorically described the new doctrine as "false and absurd philosophically, and formally heretical as expressly contradicting Scripture," a verdict which inspired the decree of the Index condemning the same as "false and altogether opposed to Holy Scripture." This over-strong statement is, however, balanced by the inconsistent permission of certain of the condemned books when corrected. For when we examine the kind of correction demanded (and actually made four years after), this did not expurgate the new doctrines, but merely softened the statement of them from an absolute assertion into an hypothetical supposition. Now, it is clear that if a theory is ascertained to be "false, heretical, and contrary to Scripture," no Church authority ought to tolerate its discussion even as a hypothesis. Hence we can only view the decree of 1616 as a "compromise"

between the extreme view and the moderate view; but a clumsy and inconsistent one, seeing that it embodies both views side by side and fails to reconcile them.

(2) As far as concerns the demands of discipline, it is clear that the second process, that of 1633, proceeded chiefly on the lines of condemning Galileo for contravening the prohibition of 1616; it is therefore in essence a vindication of the dignity and authority of the Holy Office. Its object was to treat him as a delinquent in ecclesiastical discipline, and to penalize him for disobedience. Suppose in the army an officer whose orders had been disobeyed found out in the meantime that his orders had been wrong. This would not alter the principle that "orders must be obeyed" even if thought to be wrong; nor would it prevent the subordinate from being hauled up for insubordination and punished in due course. If the questioning of orders were once admitted, there would be an end to all discipline in the army; and so, if only for form's sake and for sake of the principle, some penalty must be imposed—even though it be made a light penalty, and even though the orders themselves are subsequently withdrawn as unsound. Now, it is quite possible that there existed many in Rome who favoured Galileo's scientific enterprise and even leaned to his conclusions, and who would yet deem it expedient to penalize him for his want of obedience, simply on grounds of principle and in support of authority; and these

would give their adhesion to the substance of the sentence. On the other hand, there were certain others immovably convinced of the error of Galileo's teaching; and these would regard the action of the Holy Office not merely as a defence of discipline but also of the faith. Hence, to the substance of the condemnation on grounds of disobedience were added those definitive statements which were merely a repetition of the decree of 1616, and which describe the doctrines themselves once more as "false and contrary to the true sense and authority of Scripture"; adding that Galileo was "grievously suspected of heresy." Unfortunately, here the exigencies of discipline are exceeded and the doctrinal condemnation is made categorical and absolute.

X
V.N.K.

That Galileo's conduct as a "son of the Church" was not what it ought to have been is cordially acknowledged by Whewell (*Inductive Sciences*, p. 535), who tells us that "Leibnitz, Guizot, Spittler, Eichorn, Raumer, Ranke, and almost all persons who have studied the facts, have at last done justice to the Church; that Galileo trifled with authority to which he professed to submit, and was punished for obstinate contumacy, not for heresy. This celebrated event must be looked upon rather as a question of decorum than a struggle in which the interests of truth and free inquiry were deeply concerned."

(3) Finally, there are quite sufficient indications that the Roman Congregations were keenly interested

in the practical question as to how the novel views of Galileo would affect the simple belief of the ordinary reading public. Thus, in the course of its sentence of 1633, the Holy Tribunal expresses itself as "desirous to provide against the disorder and mischief which has proceeded from the new teaching to the detriment of the holy faith." If we link these words with the remark of Urban VIII. that "the reading of the *Dialogues* was most pernicious to Christianity," we recognise the policy of the safer course which, partly at least, lay at the back of the Galilean condemnation. The reading of the *Dialogues* could not have done much harm to the theologians who opposed them as heresy ; but they might have done a great deal of harm by discrediting the authority of Scripture in the minds of ordinary readers. They might also have done much to encourage a certain "liberalism" and independence of mind which was at this time spreading in Italy, and was rapidly tending to total unbelief. It is one of the anomalies of human affairs that truth can be and often is the cause of error, just because it is grasped as a half-truth and not understood in its full bearings ; and this is exactly what was likely to occur among the ordinary people brought face to face with Galileo's novel theories without the necessary education to understand their proper bearing.

XI. SUMMARY AND CONCLUSIONS

NOW it seems to me that, taking the official action of the Roman Congregations roughly and in the lump, and viewing the whole situation in its double context both as regards the theological and natural science and as regards the recognized principles of Church administration, sufficient has been said to enable us to view the whole affair in a far more intelligible light, and with far greater sympathy, than at first sight might be expected. But we must hasten at once with all frankness to confess that this apologetic does not amount to an entire vindication. The circumstances we have been considering may extenuate and may explain much that was done, but they do not amount to a full and complete justification of everything that was done. When all has been said on the favourable side, there still remains written across the pages of history the fact that each of the Roman Congregations, on both occasions of their official executive, committed a grievous blunder; and we are bound to go further and concede that there was sufficient light abroad at the time to have prevented that blunder. But the important thing is to make quite clear in what this blunder consisted:—

(1) It did not consist in the exercise of doctrinal caution with a view of safeguarding the deposit of faith, or of taking up the defence of the conservative attitude of defending the traditional view of Scripture against novel interpretations not yet ascertained to be unquestionably true. The deposit of faith is something far too precious to be jeopardized by an easy acceptance of new and untried doctrines, whether in science or otherwise. Time at least must be given in order to examine the validity both of the old conception and of the new one; and in the meantime it was only reasonable that the propagation of the new ideas should not be encouraged, but should even for the time be discouraged or suppressed, at least as far as their general circulation in book form is concerned. The adherence to the old view and the rejection of the new view we now recognize as a mistake; but it was an intelligible and excusable mistake, and does not amount to an egregious or monstrous blunder.

(2) It did not consist in the disciplinary act of putting certain books on the Index; for this could be justified on the ground that their teaching was rash or premature. The very commotion which arose was quite sufficient to justify this proceeding according to the lights of the time. The act may be condemned as a mistake, but it was not an egregious or monstrous mistake but quite an ordinary and natural one.

(3) It did not consist in penalizing Galileo for

his disobedience ; for this was well within the range of legitimate authority according to the standards of the Church. Here again the act may be condemned as a mistake. It is not clear that Galileo was gravely guilty of disobedience. He may possibly have obtained his *Imprimatur* in good faith, and ought not to have been punished for acting on it. It is true that he was insincere in his pretence to put forth the new doctrine hypothetically, and he might be fairly caught on this score as having written *in fraudem legis*. On the other hand, *de internis non curat prætor*—objective acts and not internal motives form the subject-matter for forensic action. Still, if the *Dialogues* seemed to be rash and calculated to do harm to the faithful by their premature circulation, it was within the competency of the court to put them on the Index, and even to penalize Galileo for his want of straightforwardness. Therefore, the mistake made was in the circumstances of the time intelligible, and did not amount to an egregious blunder.

(4) The really grave blunder consisted precisely in the categorical and dogmatic way in which the new doctrines were condemned as “false, contrary to Scripture, and heretical.” We know now that this verdict is absolutely wrong ; and the history of the times shows us that with due circumspection and moderation it could have been avoided. The blunder was, moreover, partly the outcome of human prejudice, and perhaps of human passion, in men who

ought to this extent to have been free from both defects ; and this is why we must frankly acknowledge it to be a grave one.

SOME CAUTIONS

With the foregoing fairly exhaustive study of the facts and principles before us, we can bring this series to a close by drawing up a certain number of cautions to different classes of persons, in order that they may avoid the pitfalls of the subject.

First, to all and sundry :—

In order to understand and judge soundly of the whole matter, it is necessary to dis sever yourself from the strictly modern standpoint, and to project your mind back to the actual times of Galileo and his judges, so as to see with their eyes and think with their minds. This will not blind you to the error which was actually committed ; but it will enable you to judge that error more fairly and to view it sympathetically, and will make the whole situation intelligible.

Secondly, to Protestants :—

(1) Get rid at once of the idea that the Galileo tragedy was due to the fact that his judges were Catholics, as if there were something in the Catholic creed which caused them to act as they did. We have seen that the views of the Roman authorities, both in science and in theology, were also shared by Protestants, and that the Tübingen divines acted

towards Kepler just as the Roman divines acted towards Galileo. The preconceptions in each case were common to all Christians at the time, both Catholic and Protestant.

(2) Give up all idea of using the Galileo case as an argument against Papal infallibility. The range of Papal infallibility is quite clearly defined, and does not come within touch of the case at all. Even though the whole proceedings were directed by the Pope, the deliberations, some of them at least, presided over by him, and the official results confirmed and approved by him—this does not in any way bring the matter within the range of an *ex cathedra* definition, which alone is the matter of infallibility. This is not only a commonplace among Catholics, but is fully acknowledged by Protestant writers. Thus the Protestant astronomer Proctor (*Knowledge*, vol. ix. p. 274) writes: "The Catholic doctrine on the subject [of Papal infallibility] is perfectly definite; and it is absolutely certain that the decision in regard to Galileo's teaching, shown now to have been unsound, does not in the slightest degree affect the doctrine of infallibility, either of the Pope or of the Church. The decision was neither *ex cathedra* nor addressed to the whole Church; in not one single point does the case illustrate this doctrine of Papal infallibility as defined by the Vatican Council."

Another Protestant, Karl von Gebler, in his work *Galileo Galilei and the Roman Curia*, writes to the

same effect: "We grant that the two Congregations of the Index and the Inquisition, with the two Popes who sanctioned and promulgated their decrees, were in error; but not one ever held that the decisions of the Roman Congregations were in themselves infallible, even when approved by the Pope, unless specially set forth by the Pope with all the conditions required for an *ex cathedra* definition."

Thirdly, to Catholic Apologists:—

(1) Avoid the mistake of minimizing the official action of the Church authorities, or of understating the ground of their condemnation. The official documents plainly embody the view that the Copernican theory was not only "false" but also "heretical" because "altogether contrary to Scripture"; and Galileo was condemned as "grievously suspected of heresy," which heresy is defined as "holding that the earth moved and the sun stood still." It is precisely in this dogmatical pronouncement on the heretical character of the new astronomy that their blunder consisted.

(2) Do not try to cloak this blunder by arguing that Galileo brought all the trouble on himself by meddling in theology, or by his aggressiveness of manner. The clash with theology was inevitable, and must be forced upon him; and his defence on this point was entirely sound and unexceptionable. His aggressiveness explains the amount of human passion which was aroused against him, but does not

extenuate the act of condemning officially as heresy a doctrine which we all now know to be totally free from heresy. That Galileo was imprudent in forcing an official pronouncement does not diminish the error which the official pronouncement contains.

(3) Avoid also laying too much stress on the fact that Galileo was contumacious to Church authority. His contumacy might justify a disciplinary punishment; but once more, it does not cloak the blunder of charging his doctrines with heresy.

(4) There is no reason for trying to exonerate the Popes from all share in the action of the Congregations. Although their names do not appear in any official capacity, there is no doubt that they were fully conversant with what was being done; that they partly directed the proceedings; that they approved and sanctioned the decrees issued and the sentences pronounced. Our defence on this point lies simply in the fact that the Pope's approval of the acts of a Congregation does not raise them to *ex cathedra* definitions.

Fourthly, to Liberal Catholics:—

There is no ground in the Galileo case for insinuating a general distrust of the decision of Roman Congregations in modern times. In the first place, it is not a bad record for the Congregations that they should have been working now three centuries, and yet their worst enemies can discover only one really big, obvious, and undebatable blunder in their whole

history. Secondly, the official action of the Congregations in modern times is characterized by an extreme caution which will certainly obviate such a blunder occurring again. Thus the decisions of the Biblical Commission certainly display a circumspection which deserves respect even from those who hold altogether contrary opinions. Moreover, the Holy Office and the Index have had several opportunities in recent times of repeating the Galileo incident by the over-hasty condemnation of novel scientific views bearing on theology or Scripture—for example, the arguments from geology against the universality of the deluge, or in favour of the antiquity of man; the evolutionary theory of creation, or the dynamic theory of matter, or the origin of life, or the nature of spiritism, etc. etc.,—and have escaped the snare. Such difficulties as arise in the minds of discontented “progressives” or Liberal Catholics in our own times seem most commonly to arise from want of careful study of the decisions themselves, and a consequent misunderstanding of the minimal character of their contents. The Galileo case is, in fact, unique in history because the circumstances under which it occurred were also unique.

XII. ADDITIONAL NOTES

I. LATER HISTORY OF THE DECREES

A NOTE on the subsequent history of the official decrees and of the theory which they condemned will be of interest.

In this connection it will perhaps be useful to point out the difference between the Congregation of the Inquisition or Holy Office and that of the Index. Both have for their scope to investigate "heretical pravity"—that is to say, heterodoxy of belief and teaching,—but in different ways. The Inquisition deals with persons, the Index with writings. Of the two proceedings which belong to the Galileo case, the first (that of 1616) concerned writings only, and was undertaken by the Congregation of the Index. They certainly examined Galileo's writings, and the verdict of the Qualifiers was against them, and the result was communicated privately to Galileo by the Holy Office. In the decree of the Index which follows, this fact was mentioned; but his works were not condemned by name, but only implicitly so far as they fell under the general tenor of the

decree. The second process (that of 1633), though provoked by Galileo's latest book, was undertaken by the Inquisition, because the question of his personal submission to the warning of 1616 was the head and front of the attack. To the personal sentence of the Inquisition of 22nd June 1633 a decree of the Index prohibiting his book was added on 23rd August 1634.

Bearing the difference between the two Congregations in mind, it will be clear that the sentence of 1633, being connected with a personal case, has its effect on that case only, and stands as a fact in history never to be rescinded. With the condemnation of 1616 and those that subsequently proceeded from the Congregation of the Index, which deals not with persons but with books, and doctrine contained in books, the case is different. Such prohibitions of books are capable of subsequent revision, and many of them have in point of fact been rescinded, as can be seen by comparing the latest edition of the "Index" with any of those which preceded it. Since the Congregation of the Index was founded, it has been customary from time to time to publish a collected list of the books condemned under the title of *Index Librorum Prohibitorum*. In 1664 a new edition of this list was brought out, accompanied by a bull of Pope Alexander VII. : *Speculatores Domus Israel*. The edition thus published under official sanction contained among the rest the decree of 1616 condemning the five

books therein mentioned ; also a monitum, dated 1620, permitting the reading of the works of Copernicus if published in a corrected edition ; also a decree, dated 1618, condemning Kepler's *Epitome Astronomiæ Copernicæ* ; another of 1634 prohibiting Galileo's *Dialogue* ; and finally, in 1640, a general prohibition of "all books, booklets, commentaries, epistles, glosses, sermons, tractates, etc., whether written or printed, which discoursed on the mobility of the earth and the immobility of the sun." Of course, the Papal bull which accompanied the new edition merely gave the book an official authenticity as an accurate catalogue of decrees, but did not add anything to their authority or vouch for their intrinsic correctness. Hence any attempt by reason of this bull to turn the decrees of the Index into *ex cathedra* or infallible definitions is useless, as it misses the meaning and purpose of the document.

In spite of its condemnation by the Roman Congregations, the Copernican doctrine gradually spread till it was finally clinched by Newton's *Principia* in 1696, and so secured general acceptance. The decrees of the Congregations were by no means regarded as having closed the question for Catholics ; and, generally, no scruple was felt on disciplinary grounds as regards professedly teaching the new theory in Catholic colleges. Thus, as early as 1634, leave was given to introduce instruments for the teaching of astronomy in Rome based entirely on the Copernican system. Cardinal Barberini,

nephew of Urban VIII., was presented with one of them. In 1639 and 1645 Bulialdus and Gassendi, both of them Catholic priests, undertook the defence of the Copernican system, and were neither reprimanded for it nor suspected of heretical teaching. In 1656 the *Imprimatur* was given in Rome itself for a defence of Copernicus against various physical and astronomical objections; and the same occurred again in 1667 and 1669. In 1661, P. Fabri, S.J., professor at the Roman College, publicly declared that the authorities would at once adopt the figurative explanation of the various passages in Holy Writ, if only a real proof for the Copernican system were forthcoming. P. Baldigiani, S.J., in 1678, thought that the time had come to revoke the decree forbidding the reading of the *Dialogues*; and in 1685, P. Kochansky went so far as to state that every Catholic was allowed to search for a proof of the truth of Copernicanism.

Meantime the decrees remained on the books, and presented a certain technical difficulty to the canonist. Hence, in 1757, Benedict XIV. expunged the universal prohibition of 1640. In 1744, Galileo's *Dialogo* was allowed to be included in a new edition of his collected works. In the year 1820, positive official permission was asked for and granted by Pius VII. to Canon Joseph Settle, a Roman professor, to publish a textbook on science, containing the Copernican doctrine. Finally, in 1822, the Inquisitor-General, under the sanction of Pope Leo XII., declared that the printing

and publication of works treating of the motion of the earth and the stability of the sun, according to the opinion of modern astronomers, is permitted in Rome. In the next edition of the Index, dated 1835, the decree of 1616 and all others touching the question, as well as the names of all the prohibited books, were finally expunged from the list.

The delay which elapsed before this withdrawal was made is only part of the traditional conservatism of the Church. The documents were there on record, and on record they must remain until it has become clear beyond a shadow of doubt that they are of their own nature obsolete. The same slowness shows itself in other departments. For instance, down to 1869 the canon-law books were filled with a vast mass of excommunications, suspensions, and interdicts which had accumulated from the Middle Ages, most of which were, however, entirely out of practice. And yet they continued to encumber the books for centuries till Pius IX., by one stroke of the pen, abolished them in his *Apostolicæ Sedis*, which contains a list of those censures alone which are to be regarded as in force, and abrogates the rest. There is therefore nothing strange in the belated declaration of 1822, that "in future the new astronomy was to be permitted in Rome." Practically it had long been permitted, and this was merely the legal and formal removal of a decree already recognized as a dead letter.

II. GALILEO'S PROOFS

As to the question whether Galileo had really proved the truth of the Copernican system, Müller writes as follows :—

Had Galileo any really convincing proofs? Answer: No. Had he at least probable proofs, such as to give an idea what the real proof might be? Answer: No. Were Galileo's proofs such that even those who were not experts could clearly see their unsoundness? Answer: Yes.

This is the opinion of a scientific astronomer; and hence we need not be surprised if Huxley confesses that, in his opinion, the adversaries of Galileo had rather the best of the dispute.

This we can see in detail thus :—

The 1st Proof, from the phases of Venus and Mercury.—This proves that these two planets are moving round the sun as their centre, but nothing more. With some probability one can argue by analogy that the other planets may also move round the sun; but this proves absolutely nothing about the earth. The question whether the earth is a planet or not is just the point at issue.

The 2nd Proof, drawn from the sun-spots, is such that modern astronomers are inclined to think that Galileo was not serious about it; for it is either absolutely unintelligible or, if taken as it stands, palpably wrong. Moreover, the facts adduced for the 1st and 2nd arguments (geometrically) can be

equally well explained by the old or by the new theory.

The 3rd Proof, Galileo's argument from the tides, goes straight against the facts observed. Yet Galileo did not shrink from calling the reports of two daily tides at the Atlantic coast "fables" merely invented to weaken the force of his argument.

But Galileo's arguments were not only wrong: he had also no answer to many difficulties, some of which were solved only much later:—

1st Objection.—The planets move with varying speeds round the sun. This cannot be explained by circular movements, where the speed has to be uniform. Copernicus was honest enough to admit the fact and to solve the difficulty by partially returning to the old cycloids. Kepler did away with these difficulties by proving the orbits of the planets to be elliptical (*Astronomia nova*, 1609, a copy of which was presented by the author to Galileo). Galileo, however, treated these splendid researches as "child's play," and preferred to misrepresent the Copernican system so as to avoid the difficulty; and this misrepresentation was well known to the astronomers and scientists in Rome.

2nd Objection.—Galileo could not explain why no annual parallax could be observed. The difficulty remained till 1838, when Bessel, for the first time, succeeded in showing that there *was* a parallax. To make his explanation more acceptable, Galileo gave false figures for the diameter of the earth's orbit,

such as the astronomers of the time could easily see to be wrong.

3rd Objection.—*If the earth rotates, why do the bodies not fall a little to the east?* Galileo simply denied the fact; and yet this is now not only mathematically but also experimentally proved. Galileo himself had undertaken to carry out such experiments and had conspicuously failed. This was also known in Rome, and to the astronomers of the time.

No doubt many objections urged by certain adversaries were futile, and did not show much ingenuousness; but this was not the case with all that was said against Galileo. And so it came to pass that most of the astronomers of the time, though viewing the system favourably as a working hypothesis, were against it on physical grounds. So Tycho Brahe, whose splendid observations formed the basis for the immortal works of Kepler; so Clavius, S.J., the chief astronomer and mathematician in reforming the Calendar; so Scheiner, who as astronomer was far superior to Galileo; and many others.

Accordingly, even had the Qualifiers been scientific experts, with the meagre facts available at the time they could not consider that the Copernican system was proved, or even that it rested on safer grounds than the old one. Galileo had not one convincing proof, but many positive wrong statements and facts, which were all painfully clear to the scientists of the time. Hence many of them said: Whether the

earth moves or not, is a question undecided for the moment ; but it certainly is not demonstrated to do so by the fallacious arguments of Galileo.

III. GALILEO'S CONTEMPORARIES

Galileo was not at all in advance of the time in astronomy. On the contrary, according to the testimony of many modern astronomers, he was by far outstripped by Scheiner, Marius, Kepler, Clavius, and others. Modern astronomy rests on Copernicus, Kepler, and Newton, but not on Galileo. The discoveries made by Galileo were all such that they could easily be made by anyone else, and, as a matter of fact, we know now that all his discoveries were made independently by others either before or at least shortly after him. Thus Marius, as is undoubtedly proved, observed the moons of Jupiter on the 8th January 1610, Galileo on the 7th. But whereas Marius modestly tried to make sure, and to find out something about these wonderful moons, and so kept quiet, Galileo at once trumpeted them into the world ; and so he became famous and Marius was left unnoticed. But Marius afterwards produced tables on these moons, and astronomical calculations, in comparison with which those of Galileo, published in 1616, are quite incorrect. The Roman Jesuits, especially Clavius, observed the ring-like appendages to Saturn far better than Galileo. Scheiner's work on the sun-spots in the *Rosa Ursina* leaves all that

Galileo has ever written on the same subject far behind, as is universally acknowledged by modern astronomers. That Kepler's Laws, with their immense importance, were called child's play and fantastic calculations, shows that Galileo was not deeply versed in pure mathematical astronomy ; and Fr. Müller goes so far as to call Galileo's theoretical explanations in astronomy clumsy, and belated even for his own time.

Galileo's friends were mostly religious of all orders, from the Benedictines down to the Jesuits. Castelli was a Benedictine ; Spinelli, a defender of Galileo on various occasions, a Benedictine. Among the Dominicans were Maraffi, who defended Galileo against Caccini ; Riccardi, the famous censor, who expressly stated to Galileo that he did not believe in the opposition between the Copernican system and Holy Writ ; Cavalieri, who defended the *Dialogues*, as far as the scientific question was concerned ; and others.

Among the Jesuits were Riccioli, who maintained that Galileo had not proved the earth's movements, but was otherwise a fervent admirer of Galileo ; Malcotius, praised by Galileo himself for his friendship ; Scheiner, who also in his letters after 1630 speaks in the highest terms of Galileo as a physicist ; Grassi the same ; de Cuppis ; Baldigiani, Professor of Mathematics, a fervent follower of Galileo ; Clavius, who wrote against some of Galileo's enemies ; Lorini, who expressly stated that Copernicanism was not directly against Holy Writ, but who had to keep

quiet after the first trial; Bellarmine, as is well known; Grienberger, who used to speak in very high terms of Galileo, as many letters of his pupils to Galileo show; Cavalieri, whom Galileo wished to see near him in his last days; Paullus in Vienna, who was in favour of Galileo's publications even after 1633. Among the other orders, Foscari, the Carmelite, is well known; Guevara, Theatine, who expressly held that Copernicanism was not against Holy Writ; Micanzio, a Servite, who to the last defended Galileo in a most exaggerated way; the "Jesuate" Cavalieri; the Olivetan Renieri; Failla, the Carmelite; Veglia (?) (order not known). From the secular clergy: the Cardinals Borghese, Orsini, Zoller, Bonzi, Conti, Del Monte, Bandini, D'Este, Medici, etc.; the Barberini, both uncle and nephew; the Archbishop of Siena. Piccolomini went so far that he was thought to damage the reputation of Rome by his enthusiasm for Galileo. *Monsignors*: Gherardini; Campanella, who wrote an apology for Galileo in 1633; Boccabella and Serristori, who, according to Galileo's own words, were of great assistance to him during the trial in 1633; Gassendi, Professor of Mathematics in Paris; Dini; Ciampoli, who had to suffer on account of his services to Galileo; Cesarini, and others. To know exactly what all these ecclesiastics did for Galileo, read Müller in both his books.

On the other hand, it is to be noted that the first accusations connected with the Scripture difficulty

came not from priests, but from laymen : Colombo, a Florentine nobleman, and Sizzi, also from Florence. Of those who *ex professo* wrote against Galileo before 1616, three were lay-professors and only one was an ecclesiastic—Ingholi, in Rome. Nobody will deny that there were also many among the clergy who opposed Galileo, but certainly not in a malicious or irrational way. Thus, when the first accusation reached Rome from the Dominican Lorini, he expressly states that he did not want a formal inquisition, and much less a direct accusation ; his object was only to call the attention of the authorities to the new theory and its defence on Scriptural grounds.

IV. KEPLER AND GALILEO

In the text I remarked on the similarities in the lives of Kepler and Galileo, but did not take notice of a strong difference between their characters and dispositions, which may be added here.

Kepler stood in excellent relations with Catholics, and was much respected by them, especially the Jesuits. In a letter of 1605 he wrote to a friend : “ I admire the wisdom of the Catholic Church, which, while condemning the superstitious astrology, leaves the Copernican system for the free discussion of the learned.” On hearing of the prohibition of the book of Copernicus in 1616 he wrote : “ I am informed that some have managed by their imprudent conduct to bring about that the reading of the main work of

Copernicus, which had been absolutely free for fully eighty years, has now been forbidden—at least for the time, and until it has been corrected. At the same time well-known and reliable authorities, both ecclesiastical and secular, have assured me that thereby no hindrance is intended to astronomical researches.” Later on, after the publication of the *Harmonia Mundi*, he wrote: “I ask in the name of science, that after due consideration of these new arguments Copernicus may be made free again.” But he still cautioned the Italian booksellers to sell his book only to real astronomers, and not to the general public, as he did not want to increase the public animosity on the subject. This could be done all the more easily because he was “convinced that Catholic mathematicians would readily assent to his researches.” When in 1618 his own book *Epitome Astronomicæ Copernicæ* was also prohibited, he took the matter quite calmly, and did not lose his respect for the Catholic Church.

Kepler tried without success to establish friendly relations with Galileo, communicating freely his discoveries even before they were made public, defending Galileo against his enemies, and offering his services. Galileo did not respond, and rarely answered his letters. In his writings he ignored Kepler's discoveries and even his famous “Laws”; he is, moreover, accused of giving out some of Kepler's discoveries as his own. Kepler was also a staunch supporter of the Gregorian reform of the Calendar,

the work of Pope Gregory XIII. But the University of Tübingen had taken the lead against "the work of that ravenous wolf, the Roman antichrist," and this was another cause of their ill-treatment of Kepler. Kepler's excommunication by the Lutheran divines in 1612, however—apologists need cautioning on this point—was not due to these comparatively minor offences, but to his theological activity, his disbelief of certain Lutheran tenets, and his objections to the "Formula of Concord" of 1580, which was intended to heal the divisions in the Lutheran camp.

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VI. POSTSCRIPT

While the foregoing articles were appearing in *The Examiner* [21st September 1912, *seq.*], they were being carefully read by a special student who has worked through the most recent German literature of the subject, and who furnished me with a running commentary on the whole. Besides this contribution received from a scientist in England two long letters adding useful information on several points and confirming the views of the first critic.

The trend of the criticism tendered can be summarized as follows ;—Fahie's picture of Galileo's character and conduct is somewhat too favourable. Galileo was in truth a violent, bumptious, cocksure,

headstrong, and self-conceited man, and tricky to boot. He magnified the importance of his discoveries and the cogency of his proofs beyond due proportion, and poured scorn on all and sundry, no matter how eminent, who did not accept them implicitly, or who passed criticism on them. Moreover, several of his discoveries were really made before by others, and caught hold of and published as if they were his own; while other alleged discoveries proved not to be discoveries at all, but downright blunders. His vanity and self-conceit led him to thrust himself forward in a way calculated to breed disgust; and, being a big talker, by too free a use of his tongue he created the impression that "a sound dressing-down" would do him a world of good. His endeavours to secure the *Imprimatur* were astute and cunning, and his whole dealings with the Church authorities were slippery. Considering that they were personally unconvinced by his arguments, his *Dialogues*, which rained contempt on all that were not convinced Copernicans, were a direct slap in the face for them, and equivalent to telling them that they were all fools. It is true that among his opponents there were many of mediocre calibre who were actuated by an obscurantist conservatism, jealousy, and the bitterness of malice. But his real opponents in the higher circles counted among them men of far greater scientific attainments than his own, who saw through his superficiality and beyond it. Hence it is not correct

to dignify the severe treatment Galileo received from the authorities as a martyrdom, or to imagine that they were actuated by malice. On the whole, he brought the mischief on himself, and, considering the provocation given, was treated with remarkable moderation. The part played by the alleged poking fun at the Pope in the proceedings of 1633 has been exaggerated by Fahie and others. It is not denied that Urban VIII. felt the insult; but he did not allow it to enter as a factor into his policy, which was determined by higher and more objective motives, namely, the maintenance of Church discipline and the safeguarding of the common faithful. Finally, the same authors have exaggerated the "unrelenting though petty severity" with which he was treated during his retirement after the sentence of 1633.

This criticism shows us that the standard history of Galileo—in English at least—has yet to be written. Among non-Catholic writers the natural feeling is one of sympathy with Galileo and antipathy to the conduct of the Church tribunals; and it is possible, with this prepossession in mind, to make a serious and honest attempt to be fair and impartial, and yet to miss the correct balance. Much of the information about Galileo's discoveries comes from himself, and, owing to his enthusiastic character, may be exaggerated and misleading. But still it is quite possible that Galileo's opponents may have belittled him and given him less credit

than he deserves. Then again, much of our information about Galileo's enemies comes also from Galileo himself, who was certainly quite capable of making the most of their weak points, and is even accused of inventing injurious skits and absurd stories about them. But then some of his enemies may possibly have done the same to him, by presenting his conduct in the worst possible light. This being the case, the historian approaching the subject with a *penchant* for Galileo is quite likely to swallow as good evidence all that makes in favour of the one side, and to discount much that makes in favour of the other. And thus, by a subconscious selection, the resultant picture will be one-sided, even if not positively false.

On the other hand, it must in fairness be allowed that a Catholic writer may be permeated by a similar bias. His instinctive propensity will be to defend the action of the Church authorities from the attacks of Protestants, and to provide an antidote to the one-sided views of outsiders. And thus, without the least intention to manipulate history, he is likely to be struck with the evidences which tell against Galileo and in favour of his opponents; and the result may thus be just as one-sided as the other.

I do not intend by these remarks to insinuate anything against the German writers on whom our two contributors rely. I only mean to say that, not having examined their works for myself, I find it natural to maintain a certain suspension of judge-

ment. Nevertheless, in reprinting the articles, I have taken into consideration the criticisms offered during their serial publication and have either accepted the new evidence and changed certain detailed statements, or have expunged them as doubtful. A similar modification has been made in the treatment of the motives ; and these changes will of themselves make a corresponding change in the general impression. The modified text has been carefully read over by the first of our contributors, who has expressed himself satisfied that all is correct and up to date—at least within the range of debatable opinion.

It is, however, quite possible that the same or other special students of the subject may continue their interest in this attempt, and that by their aid the little book may be brought to a higher degree of perfection in the event of a future edition. Meantime, I feel satisfied that the work as it stands can be taken as reliable, at least as regards all substantial issues.